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AIR WEATHER SERVICE TECHNICAL REPORT

AD-218079

A DIGEST OF OBJECTIVE METHODS FOR FORECASTING STRONG SURFACE WINDS

(SOUTHWESTERN UNITED STATES – EARLY SPRING)

THOMAS H. SIMMONDS

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Section I - INTRODUCTION

Forecasting the occurrence of strong, gusty surface winds above critical operational values, usually 30 knots, is a major problem at many air bases in the Southwestern United States' "dust-bowl" area. This Report includes 15 objective forecasting methods which were prepared at Headquarters Air Weather Service for the air bases in this area. These studies are, however, limited to forecasting strong surface winds only during the months of February, March, and April. Whether or not the methods developed are applicable to the other months of the year requires further testing. Also, the methods do not attempt to include the forecasting of any associated phenomena, such as blowing dust, which frequently accompany the stronger surface winds.

The occurrence of blowing dust is dependent on many factors other than strong surface winds. The frequency and amount of precipitation, the local climate, vegetation, terrain, and soil character are all important factors in determining whether blowing dust will occur. Since the local forecaster is much better able to judge the relative importance of each contributing factor on any given day, he should first forecast whether strong surface winds are expected. Then consider separately whether blowing dust will accompany them.

Each strong-surface-wind forecasting method contains the forecasting scatter diagrams, a forecasting check list, the stepwise procedures followed in making the forecast, and finally the results of a test of the method on independent data.

The following discussion of these methods uses Amarillo Air Force Base, Texas, as an example. However, the forecasting limitations discussed in paragraph 2.4 are most important, and they apply also to the wind-forecasting methods for all the other air bases included in this Report.

The graphical analyses and the form of presentation used in this Report will also serve as a practical guide to any base which has a similar strong, gusty-wind forecasting problem for which it is attempting to prepare an objective solution.

Section II - DISCUSSION OF METHODS

2.1. The Problem.

In defining the problem for any base, it was ascertained that strong, gusty surface winds of about 30 knots or more produced the conditions hazardous to the operation of aircraft. It was also determined that these winds occurred primarily during the "windy" months of February, March, and April, and that the surface-wind forecasts were needed from 12 to about 24 hours in advance. With these time limits established, the problem is: to forecast (once every 12 hours) for the period 12 to 24 hours in the future, the occurrence or nonoccurrence of strong surface winds with gusts of 30 knots or more which continue for a period of four hours or more. Also, the forecasting methods developed are to be valid for the months of February, March, and April.

In order to properly prepare objective methods of this type, it is necessary to work with an exact statement of the problem which must contain definitely established meteorological and time limits. However, the final methods developed are seldom so sensitive that they will forecast exactly within the original limits specified. For example, these methods are designed to forecast strong, gusty winds of 30 knots or more 12 to 24 hours in advance, which last for a duration of at least four hours. Yet, many times the method will indicate occurrences only 8 to 12 hours in advance, on occasion up to 28 hours in advance, with gusts of only 28 to 30 knots which last less than four hours. These inherent limitations must be taken into account when forecasting and verifying the methods.

2.2. Period of Data and Analysis Conducted.

The data for the months of February through April for the five-year period 1953 through 1957 were used in the preparation of these methods.

During the investigative phase, many possible predictors were tested. The best predictors found are used in the combinations shown on the scatter diagrams evolved for each base. In developing the objective-forecasting method for each base, the analysis of the data were made entirely through the use of scatter diagrams.

2.3. Example of Use of Method.

Usually only three scatter diagrams were required to objectively forecast the occurrence of strong winds at a base. However, at a few bases four scatter diagrams were required. In addition, for each base a suggested forecasting check list has been prepared to be used in conjunction with the scatter diagrams for that base.

The method developed for forecasting strong surface-winds at Amarillo Air Force Base, Texas, will illustrate how the objective method is used to make a strong-winds forecast. By referring to the Forecasting Check List for Amarillo AFB, to make an objective forecast from the 1200Z data, for example, one has only to determine:

a. Previous 0000Z LND 500-mb height* = 850
b. Present 1200Z LND 500-mb height* = 835
c. The 12-hour, 500-mb height change = -15
d. Previous 0000Z ELP 500-mb height* = 900
e. Present 1200Z ELP 500-mb height* = 890
f. The 12-hour, 500-mb height change = -10

On Scatter Diagram I for Amarillo, the Lander (LND) 12-hour, 500-mb height change (12-hour ΔH) in tens of feet is the abscissa, and the El Paso (ELP) 12-hour, 500-mb height change in tens of feet is the ordinate. Notice that the height values on all the scatter diagrams are in tens of feet.

Entering Diagram I with the values for Item c (-15) and Item f (-10), the example falls in Area "B," of the Diagram. Hence, Scatter Diagram II is required. (If the case had fallen in Area "A" of Diagram I, the forecast would have been "No," and the forecasting procedure stopped.) Next, from the Forecasting Check List determine:

g. Present 1200Z OKC 850-mb wind direction = 220°

h. Present 1200Z OKC 500-mb wind direction = 260°
i. OKC 850-mb to 500-mb directional wind shear (in tens of degrees with veering +, backing -) = +4
j. The height difference, ELP (Item e) minus LND (Item b) = 55

On Scatter Diagram II, the Oklahoma City (OKC) directional wind-shear from the 850-mb to the 500-mb surface (in tens of degrees) is the abscissa, and the ELP 500-mb height minus the LND 500-mb height is the ordinate. In this Diagram, the wind shear is considered plus, if it veers from the 850- to the 500-mb surface, and minus if it backs.

Entering Diagram II with values from Item i (+4) and Item j (55), the case falls in Area "D." Hence, Diagram III is used. (Had the case fallen in Area "C," the forecast would have been "No," and the procedure stopped.)

k. Present 1200Z CBI 500-mb height* = 895
l. Present 1200Z LND 500-mb height* = 835
m. Height difference, CBI (Item k) minus LND (Item l) = 60
n. Previous 0000Z GJT 500-mb height* = 870
o. Present 1200Z GJT 500-mb height* = 860
p. The 12-hour, 500-mb height change = -10

On Diagram III, the Columbia (CBI) 500-mb height minus the LND 500-mb height is the abscissa, and the Grand Junction (GJT) 12-hour, 500-mb height change is the ordinate. Entering Diagram III with values from Item m (60) and Item p (-10), the case falls in Area "E." Hence, the forecast is "Yes." (Had the case fallen in Area "F," the forecast would have been "No.")

So that strong, gusty surface winds above 30 knots are forecast to occur at Amarillo AFB between 12 and 24 hours in the future, and these winds can be expected to last for at least four hours duration.

2.4. Method Limitations.

There are several limitations to the objective forecasting methods included in this Report, and these must be taken into account when preparing a strong surface-wind forecast for any of the bases included. These limitations are:

a. These methods are not reliable for forecasting strong winds from the northeasterly quadrant.

b. These methods are not reliable for forecasting high winds for a duration less than four hours.

c. These methods cannot be used if surface winds above 30 knots are present at the time of observation.

d. These methods will not forecast strong and gusty surface winds due to local thunderstorm activity.

e. Once these methods forecast (at time T) the occurrence of strong winds, do not alter the forecast (even though the next 12-hour observations may indicate a non-occurrence) until after the strong winds have occurred and ceased. Change the forecast only if the strong winds have not occurred within 24 hours of time T, and the T+24-hour observations indicate "nonoccurrence."

2.5. Comments.

Many times in using these methods, missing data will necessitate substituting mean or interpolated values in order to use the methods. Great care should be used in doing this as very radical weather changes can occur in a 12-hour period. For example, when forecasting for Amarillo (AMA), and the Oklahoma City (OKC) observation is missing, it is suggested that AMA be substituted and a record kept on how it performs in the method.

Objective forecasting methods of this type are never really completed. The user must continually add through experience current data and refinements to increase its accuracy and utility.

In all of these methods, the plots of actual data have been included in the scatter diagrams to indicate the technique used in separating the occurrence (X) cases from the nonoccurrence (•) cases.

* as received in raob code (10's of feet)

2.6. Evaluation of the Methods.

An evaluation of the method evolved for each base was made on four months of independent data which were chosen at random from the months of February, March, or April. The results of these evaluations are included in a Contingency Table with the method given for each base. The skill-score value accompanying each Contingency Table was computed in accordance with the method shown on page 10 of AWSM 105-40 (Rev.), dated April 1955.

Section III

THE OBJECTIVE PROCEDURES DEVELOPED FOR THE 15 AIR FORCE BASES IN THE SOUTHWESTERN UNITED STATES

These procedures are conveniently grouped for reference first by State and then by the base's proximity within each State. The order used is as follows:

Sub-Section	Name	State
3.1.	Amarillo AFB	Texas
3.2.	Sheppard AFB	Texas
3.3.	Reese AFB	Texas
3.4.	Dyess AFB	Texas
3.5.	Webb AFB	Texas
3.6.	Carswell AFB	Texas
3.7.	Biggs AFB	Texas
3.8.	Holloman AFB	New Mexico
3.9.	Walker AFB	New Mexico
3.10.	Cannon AFB	New Mexico
3.11.	Kirtland AFB	New Mexico
3.12.	Vance AFB	Oklahoma
3.13.	Tinker AFB	Oklahoma
3.14.	Altus AFB	Oklahoma
3.15.	Post Field	Oklahoma

3.1. AMARILLO AIR FORCE BASE, TEXAS

Problem: To forecast strong surface winds accompanied by gusts of 30 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	22	4	26
Nonoccurrences	7	147	154
TOTAL	29	151	180

Skill Score = .77
Percent Correct = 94

AMARILLO AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	LND 500-mb height (Time T-12)*		
(b)	LND 500-mb height (Time T)*		
(c)	LND 12-hour, 500-mb height change		
(d)	ELP 500-mb height (Time T-12)		
(e)	ELP 500-mb height (Time T)		
(f)	ELP 12-hour, 500-mb height change		
(g)	OKC 850-mb wind direction		
(h)	OKC 500-mb wind direction		
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		
(j)	Item (e) minus Item (b)		
(k)	CBI 500-mb height		
(l)	LND 500-mb height		
(m)	Item (k) minus Item (l)		
(n)	GJT 500-mb height (Time T-12)		
(o)	GJT 500-mb height (Time T)		
(p)	GJT 12-hour, 500-mb height change		

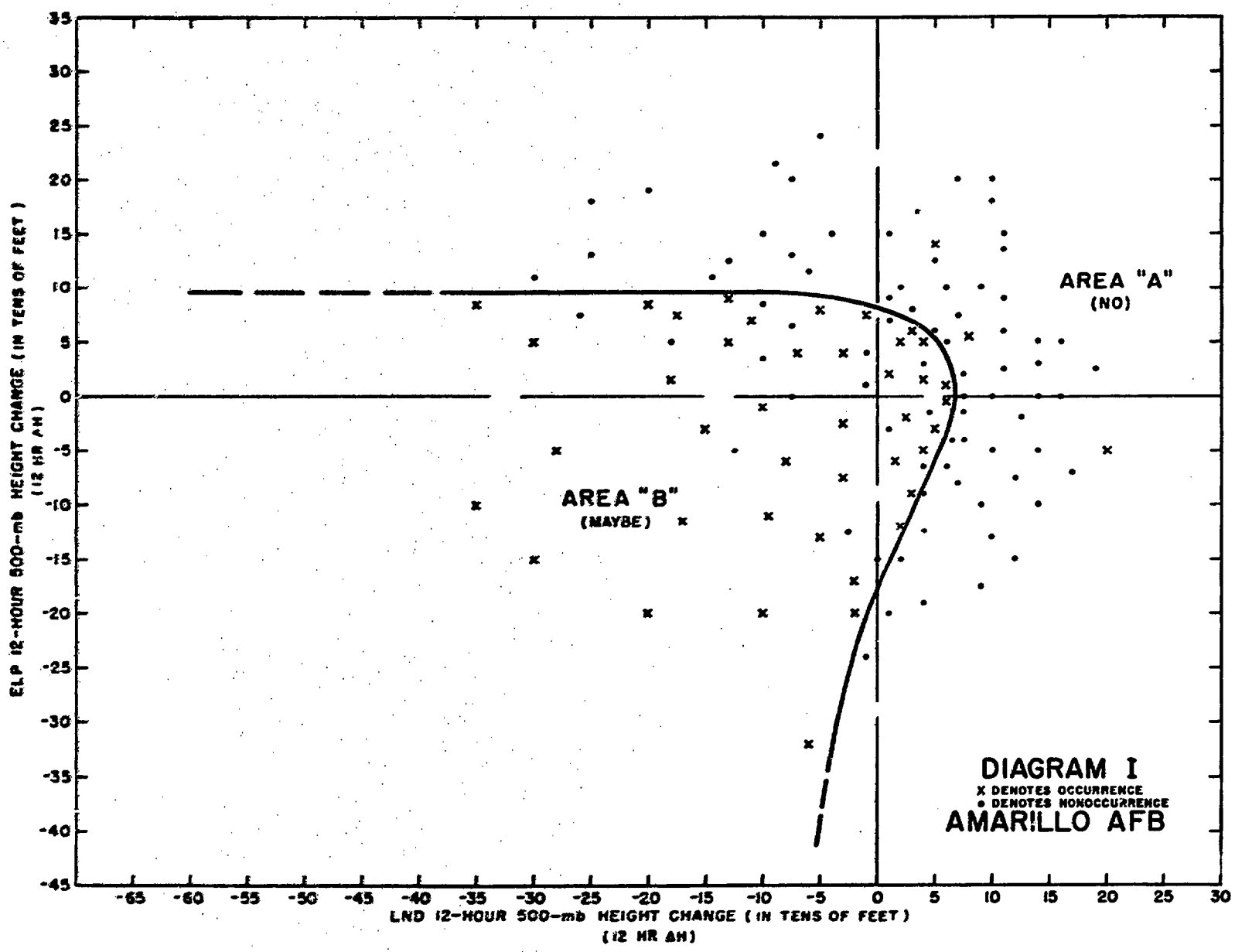
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

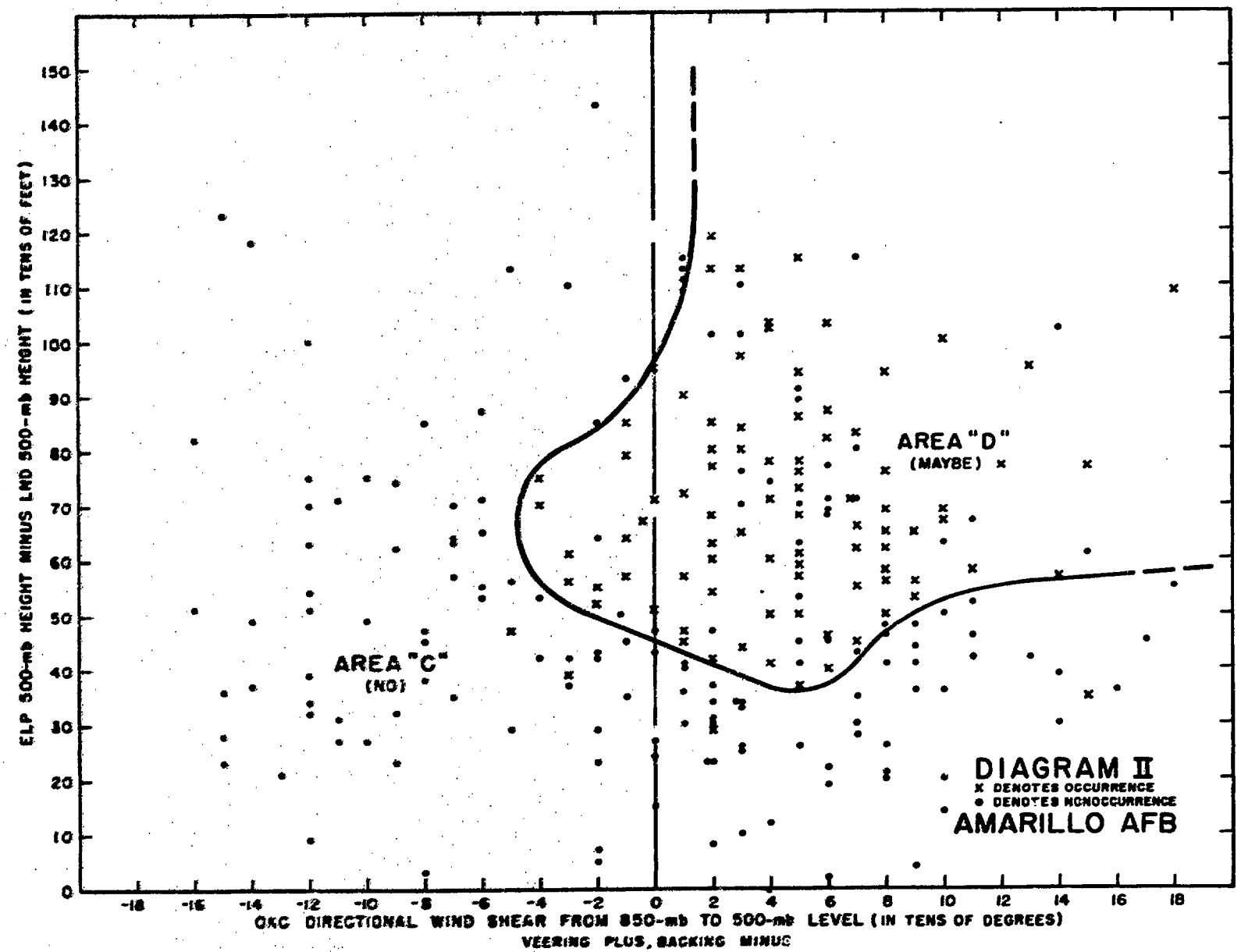
SCATTER-DIAGRAM PROCEDURE

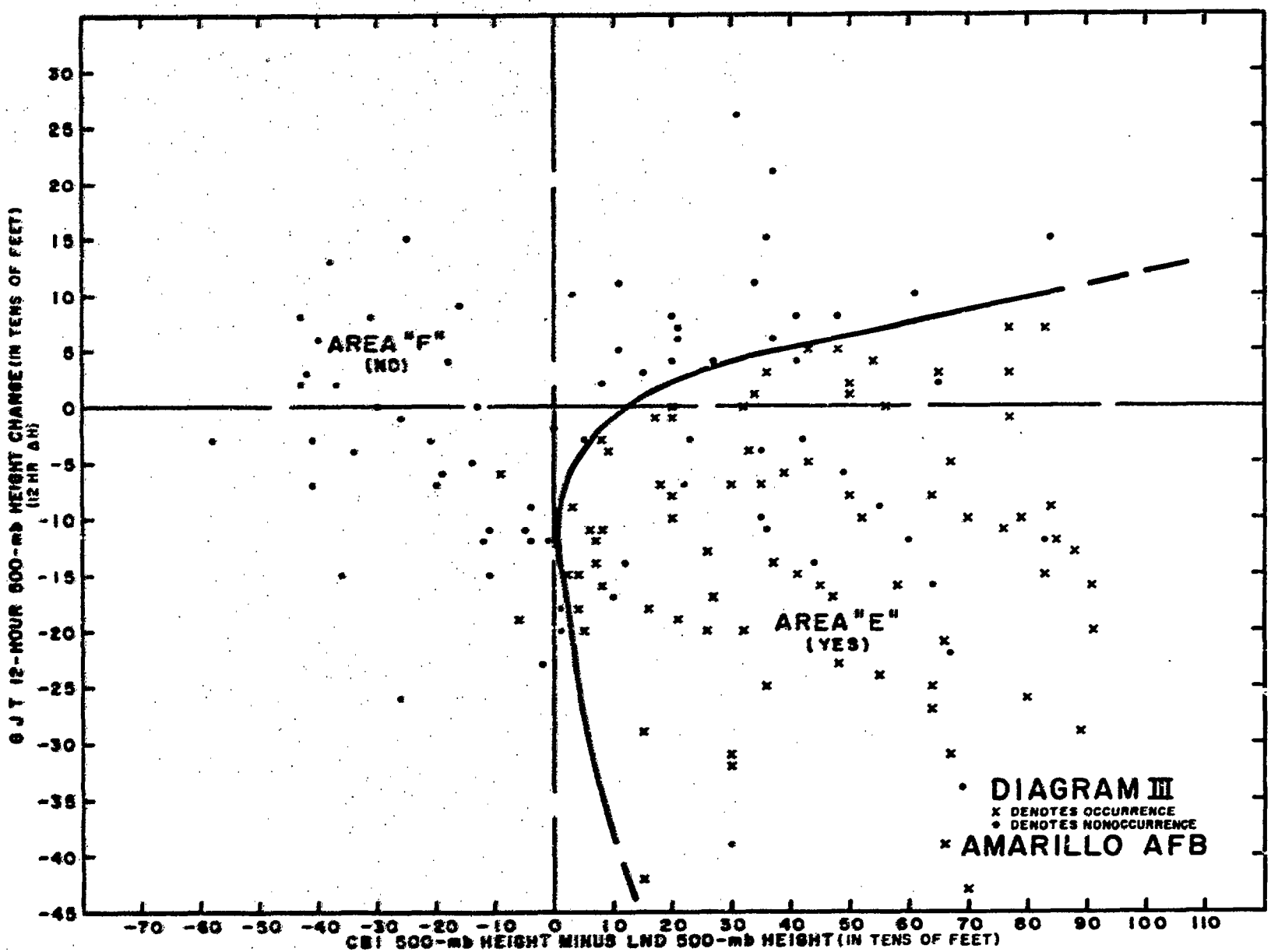
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

2. With values from Items (i) and (j) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. _____

3. With values from Items (m) and (p) enter Diagram III.
   If point falls in Area "E," forecast "Yes."
   If point falls in Area "F," forecast "No." _____


ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
LND 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
AMARILLO AFB


ELP 500-mb HEIGHT MINUS LND 500-mb HEIGHT (IN TENS OF FEET)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-18
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
18
OKC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
AREA "C"
(NO)
AREA "D"
(MAYBE)
DIAGRAM II
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
AMARILLO AFB


AREA "F"
(NO)
AREA "E"
(YES)
DIAGRAM III
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
AMARILLO AFB
6 J T 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
CSI 500-mb HEIGHT MINUS LND 500-mb HEIGHT (IN TENS OF FEET)
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110

3.2. SHEPPARD AIR FORCE BASE, TEXAS

Problem: To forecast strong, gusty surface winds of 25 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	13	3	16
Nonoccurrences	2	130	132
TOTAL	15	133	148

Skill Score = .82
Percent Correct = 97

SHEPPARD AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	GJT 500-mb height (Time T-12)*		
(b)	GJT 500-mb height (Time T)*		
(c)	GJT 12-hour, 500-mb height change		
(d)	ELP 500-mb height (Time T-12)		
(e)	ELP 500-mb height (Time T)		
(f)	ELP 12-hour, 500-mb height change		
(g)	OKC 850-mb wind direction		
(h)	OKC 500-mb wind direction		
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		
(j)	CBI 850-mb wind direction		
(k)	CBI 500-mb wind direction		
(l)	CBI directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		
(m)	OKC 500-mb height (Time T-12)		
(n)	OKC 500-mb height (Time T)		
(o)	OKC 12-hour, 500-mb height change		
(p)	SAT 500-mb height		
(q)	Item (p) minus Item (b)		

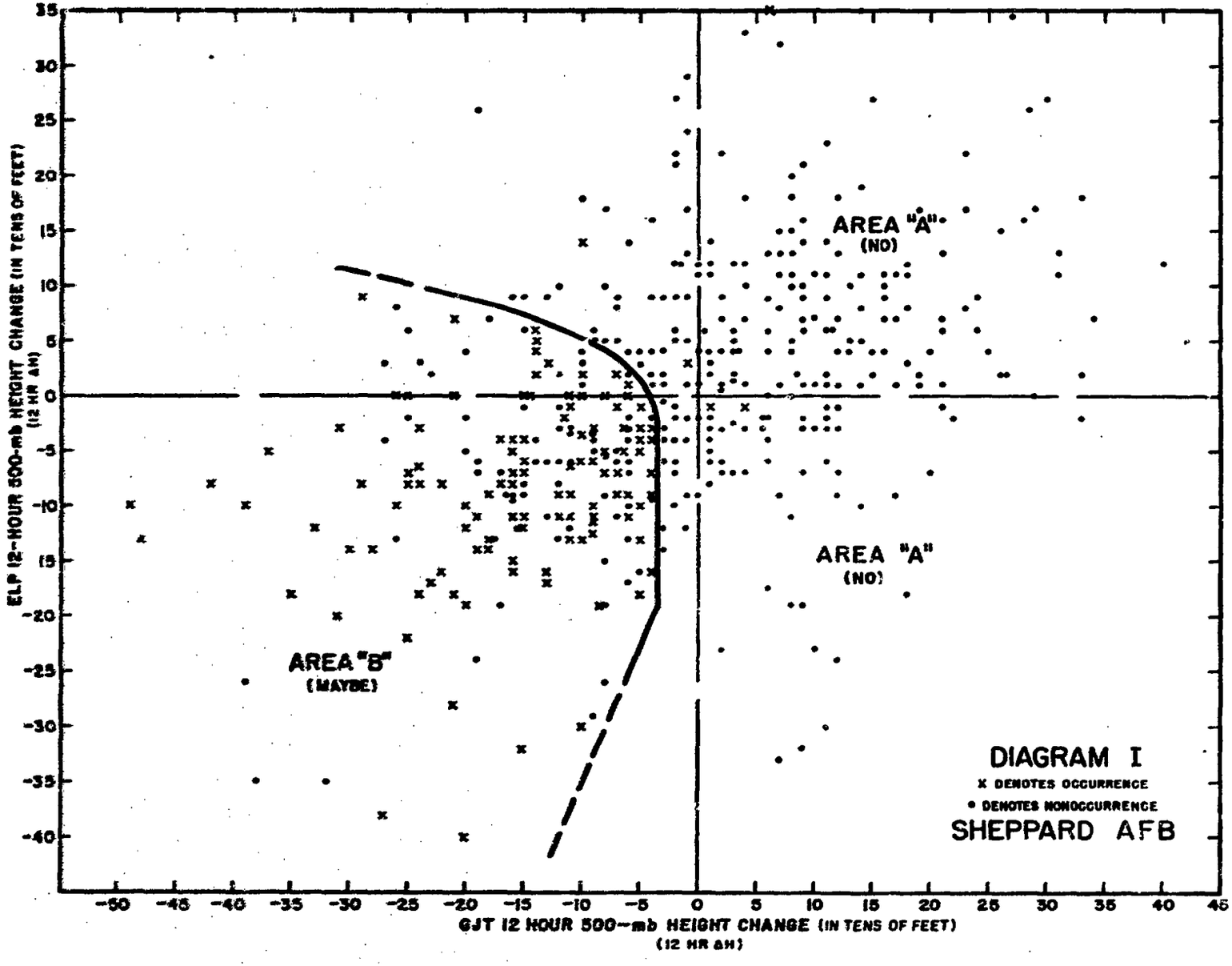
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

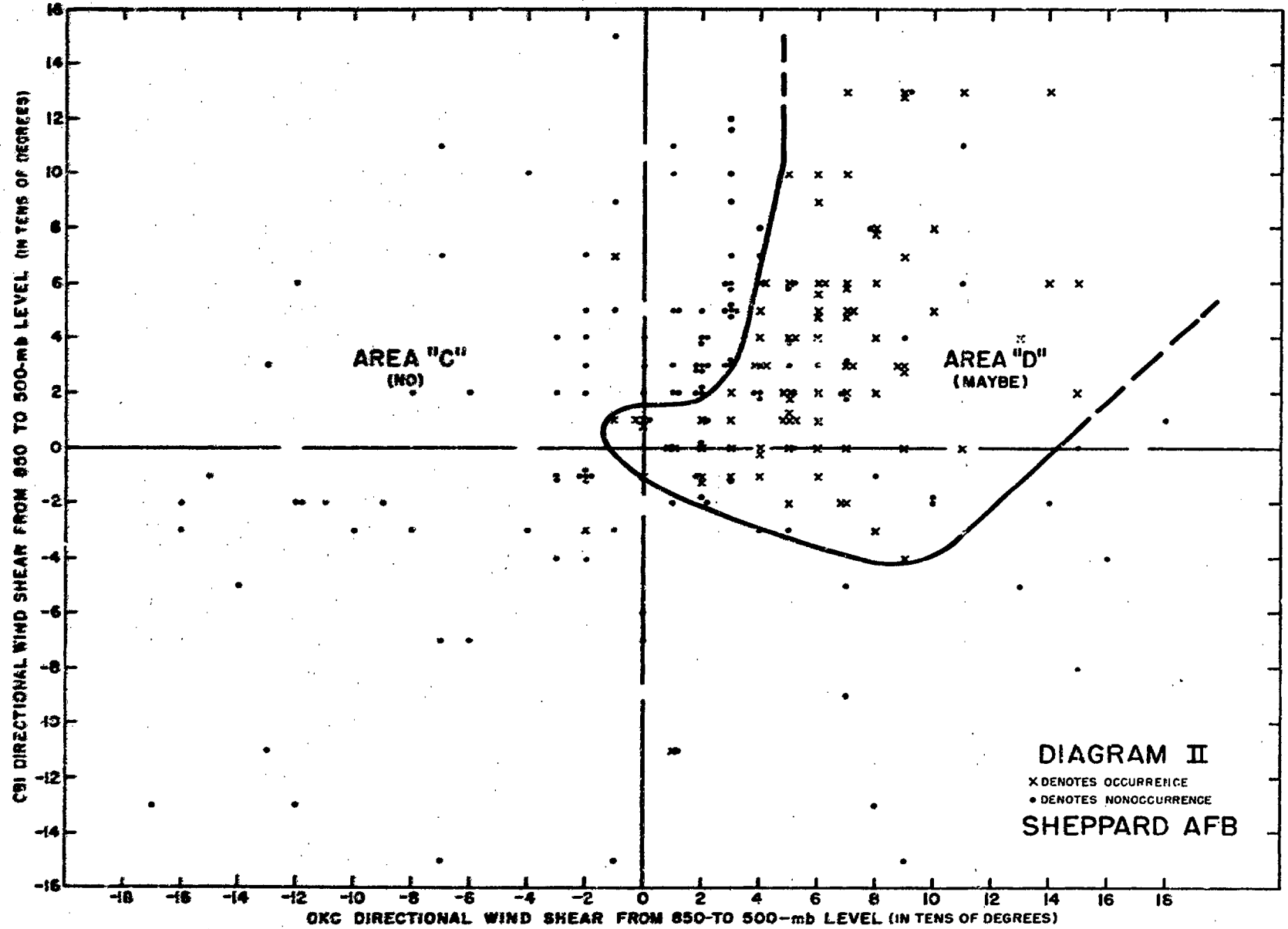
SCATTER-DIAGRAM PROCEDURE

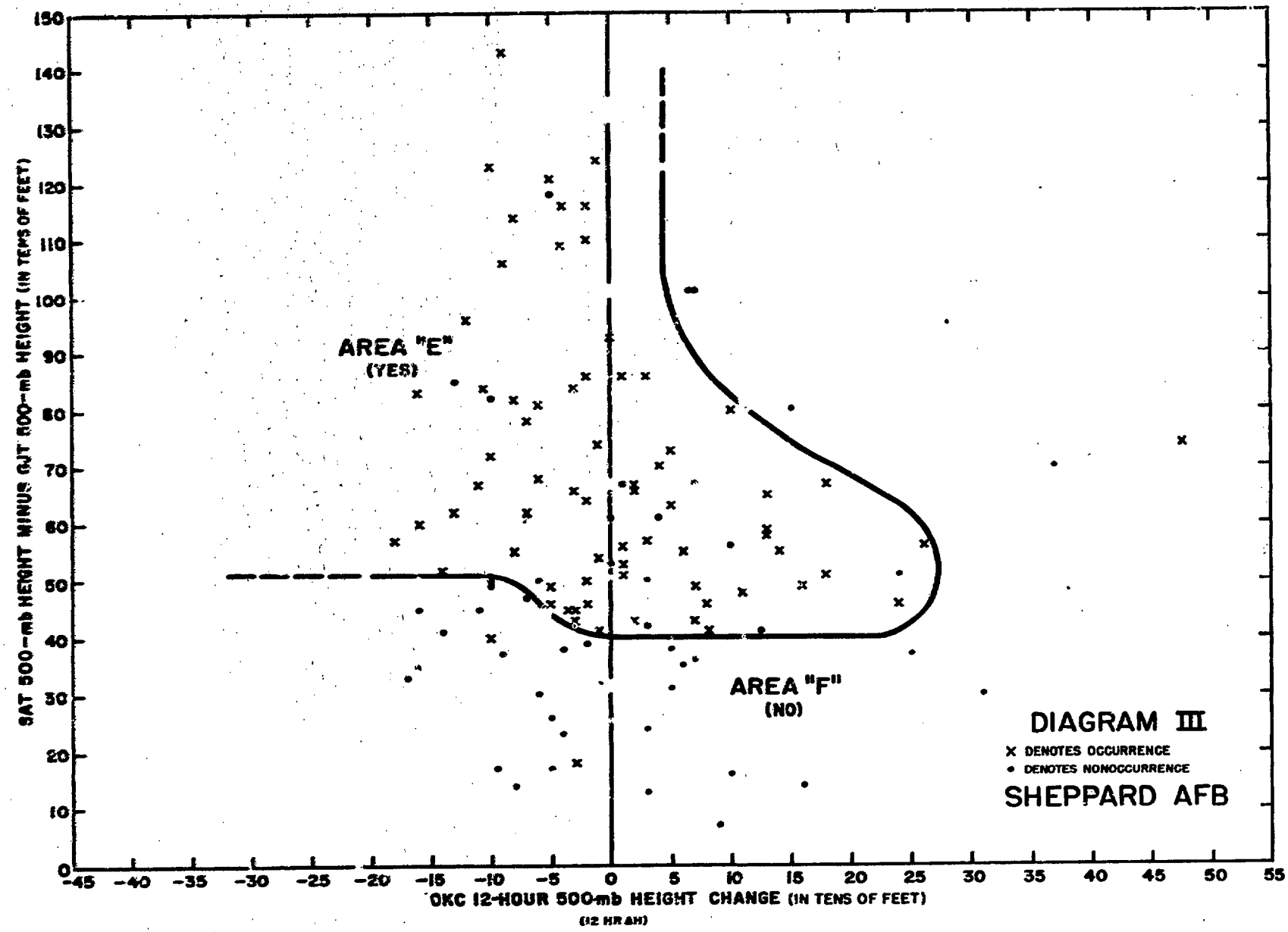
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. _____

3. With values from Items (o) and (q) enter Diagram III.
   If point falls in Area "E," forecast "Yes." _____
   If point falls in Area "F," forecast "No." _____


ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
GJT 12 HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "A"
(NO)
AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
SHEPPARD AFB


AREA "C"
(NO)
AREA "D"
(MAYBE)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
SHEPPARD AFB
CSI DIRECTIONAL WIND SHEAR FROM 850 TO 500-mb LEVEL (IN TENS OF DEGREES)
OKC DIRECTIONAL WIND SHEAR FROM 850-TO 500-mb LEVEL (IN TENS OF DEGREES)


SAT 500-mb HEIGHT MINUS OUT 500-mb HEIGHT (IN TENS OF FEET)
OKC 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "E"
(YES)
AREA "F"
(NO)
DIAGRAM III
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
SHEPPARD AFB

3.3. REESE AIR FORCE BASE, TEXAS

Problem: To forecast strong, gusty surface winds of 30 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	29	3	32
Nonoccurrences	8	184	192
TOTAL	37	187	224

Skill Score = .81
Percent Correct = 95

AWS TECHNICAL REPORT
NO. 105-149

Headquarters
AIR WEATHER SERVICE (MATS)
United States Air Force
Scott AFB, Ill., 1 April 1959

FOREWORD

1. Purpose. This Report is published for use as a guide to objective forecasting methods for strong, gusty surface winds in the Southwestern United States and for other areas having a similar problem. The methods in this Report can also be used by detachments forecasting for flights into the Southwestern United States.

2. Scope. The forecasting of early springtime strong, gusty surface winds at 15 USAF air bases in the Southwestern United States was investigated and objective methods for the forecasting surface winds at each base were developed. Although each method has been tested on independent data, actual on-the-spot evaluations will also be conducted during the windy season of 1959.

3. Credits. In addition to Mr. Thomas H. Simmonds, the contribution of TSgt John T. Thornberry to this Report is also acknowledged. His many suggestions as well as his patient processing of the data assisted greatly in its preparation.

4. Additional Copies. Additional copies of this Report may be requisitioned from Headquarters Air Weather Service, ATTN: AWSAS, in accordance with AWS Regulation 0-3.

APPROVED:

Robert D. Fletcher

ROBERT D. FLETCHER
Director, Scientific Services

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3.9.	Walker Air Force Base, New Mexico	24
3.10.	Cannon Air Force Base, New Mexico	26
3.11.	Kirtland Air Force Base, New Mexico	28
3.12.	Vance Air Force Base, Oklahoma.	30
3.13.	Tinker Air Force Base, Oklahoma	32
3.14.	Altus Air Force Base, Oklahoma	34
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REESE AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	LND 500-mb height (Time T-12)*		
(b)	LND 500-mb height (Time T)*		
(c)	LND 12-hour, 500-mb height change		
(d)	ELP 500-mb height (Time T-12)		
(e)	ELP 500-mb height (Time T)		
(f)	ELP 12-hour, 500-mb height change		
(g)	OKC 850-mb wind direction		
(h)	OKC 500-mb wind direction		
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		
(j)	Item (e) minus Item (b)		
(k)	ELP 700-mb height (Time T)		
(l)	CBI 700-mb height (Time T)		
(m)	Item (k) minus Item (l)		
(n)	OKC 700-mb height (Time T)		
(o)	LND 700-mb height (Time T)		
(p)	Item (n) minus Item (o)		

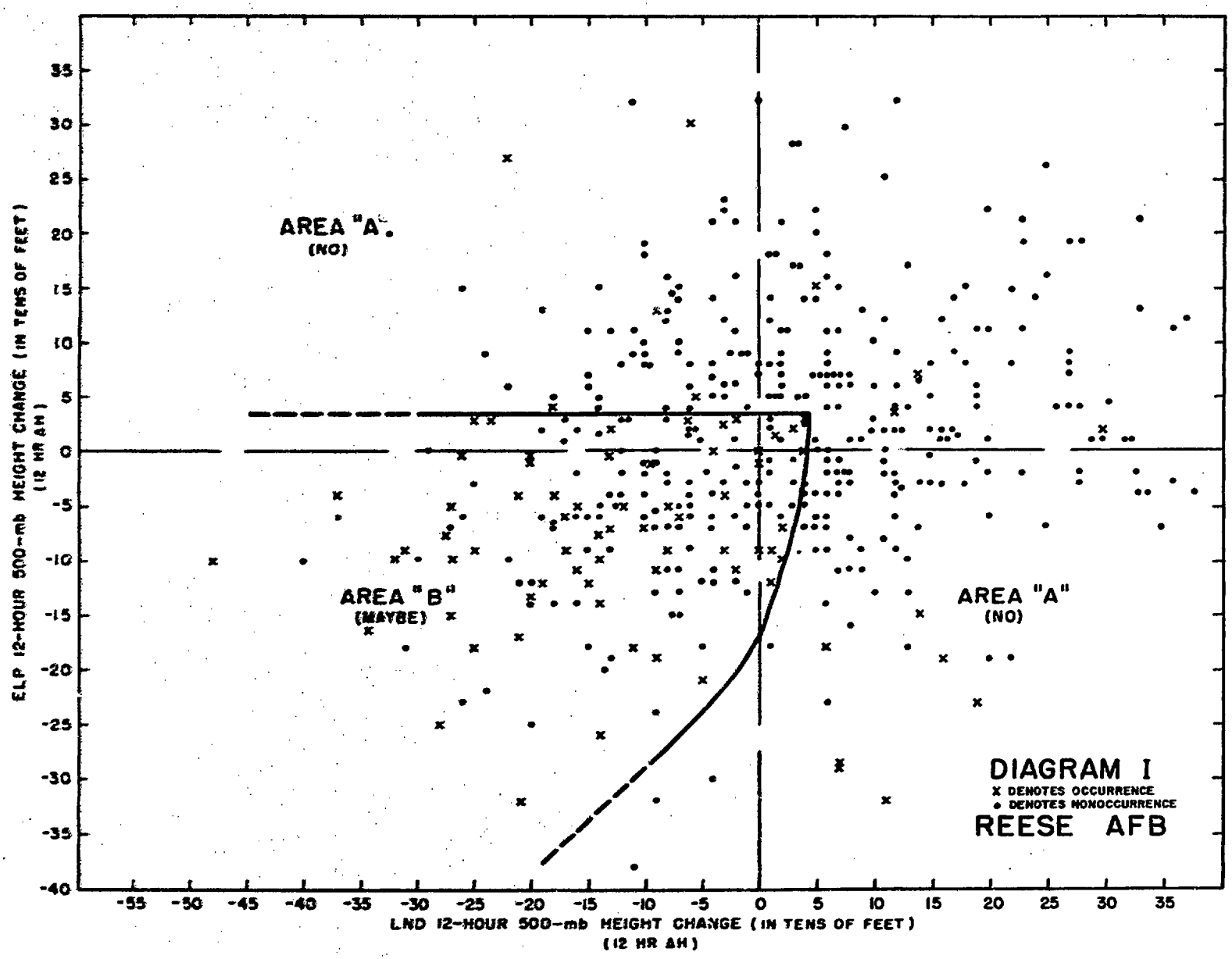
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

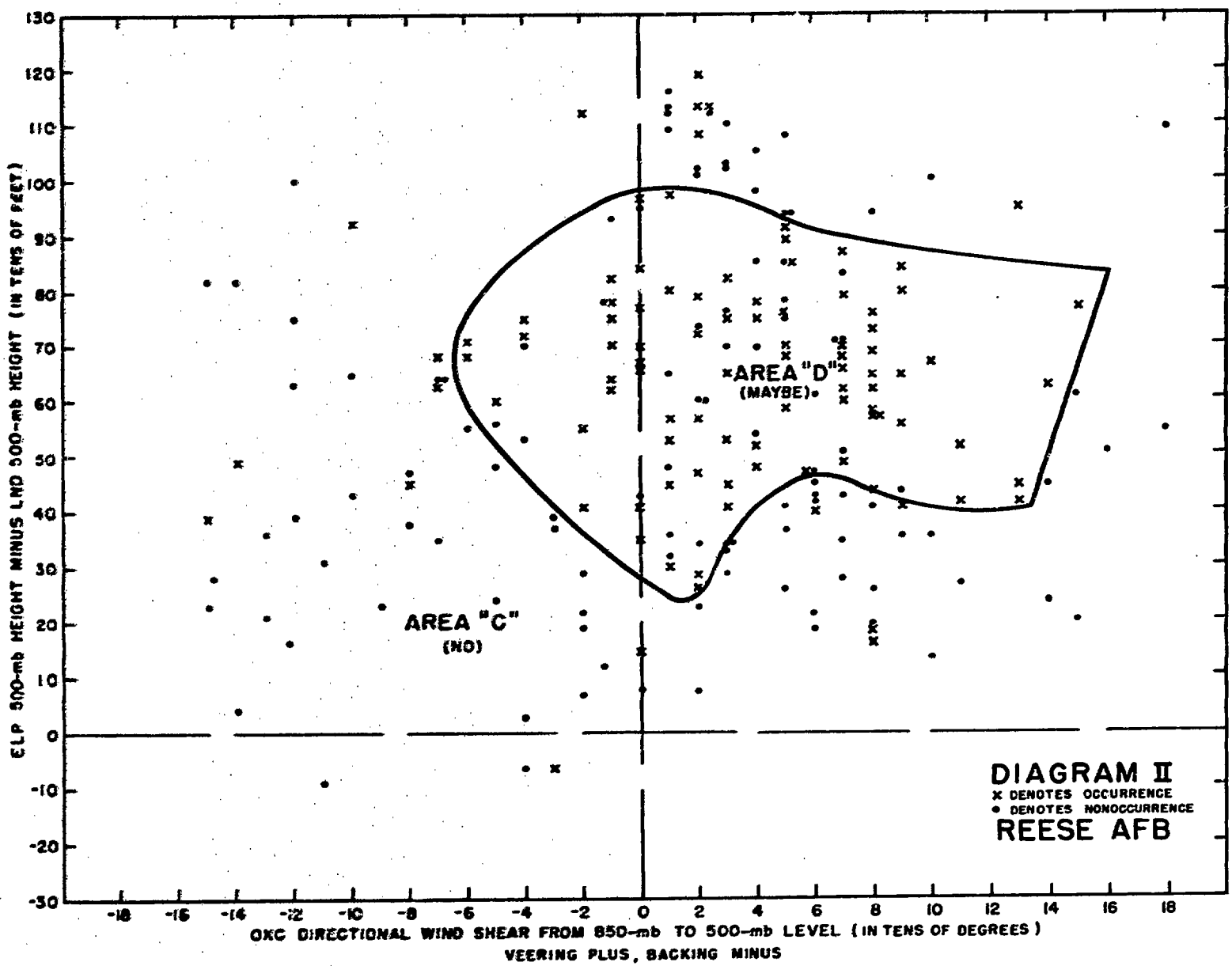
SCATTER-DIAGRAM PROCEDURE

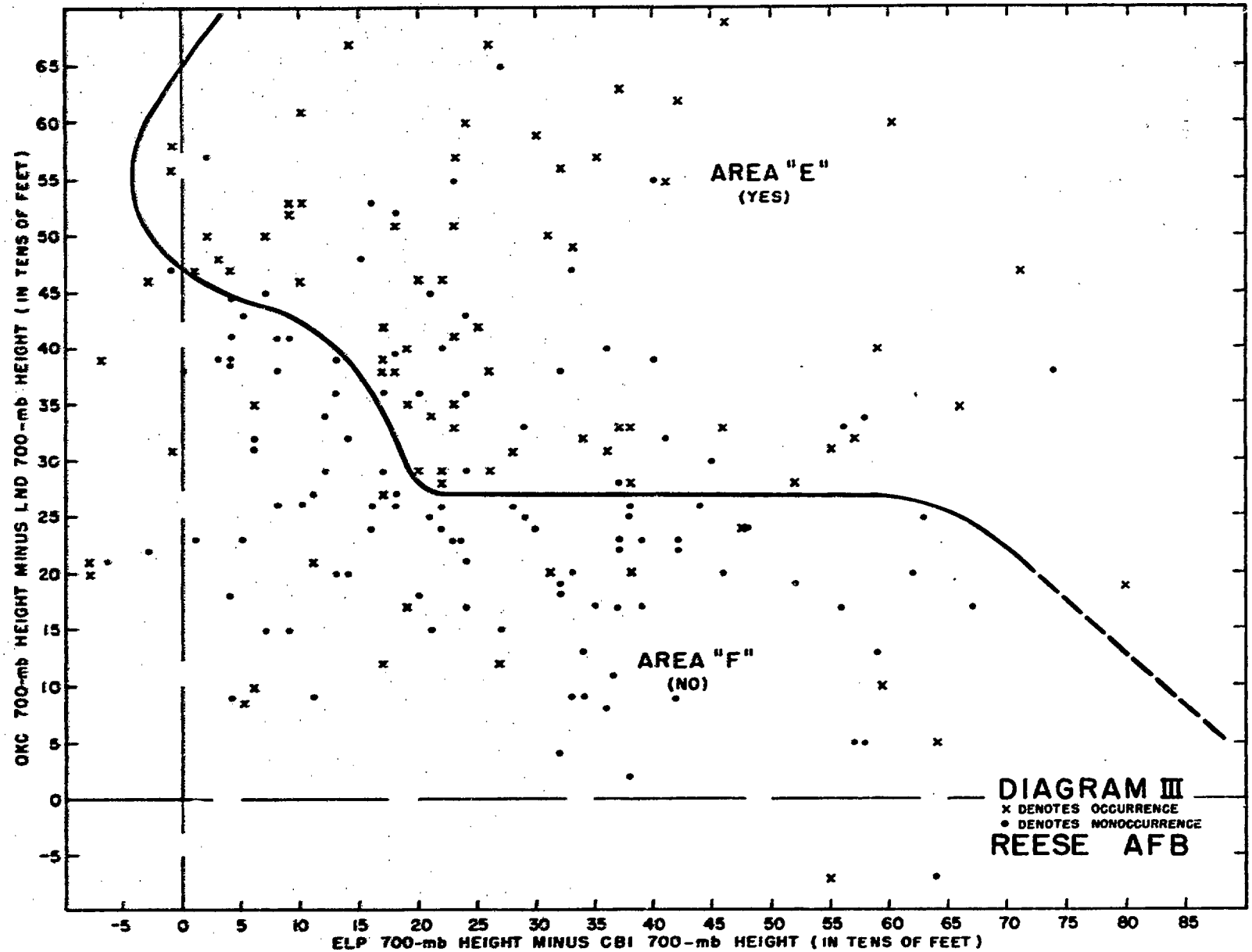
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

2. With values from Items (i) and (j) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. _____

3. With values from Items (m) and (p) enter Diagram III.
   If point falls in Area "E," forecast "Yes." _____
   If point falls in Area "F," forecast "No." _____


AREA "A"
(NO)
AREA "B"
(MAYBE)
AREA "A"
(NO)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
REESE AFB
ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
LND 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-55 -50 -45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35


ELP 500-mb HEIGHT MINUS LND 500-mb HEIGHT (IN TENS OF FEET)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-18
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
18
OXC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
AREA "C"
(NO)
AREA "D"
(MAYBE)
DIAGRAM II
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
REESE AFB


AREA "E"
(YES)
AREA "F"
(NO)
DIAGRAM III
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
REESE AFB
OKC 700-mb HEIGHT MINUS LND 700-mb HEIGHT (IN TENS OF FEET)
ELP 700-mb HEIGHT MINUS CBI 700-mb HEIGHT (IN TENS OF FEET)
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85

3.4. DYESS AIR FORCE BASE, TEXAS

Problem: To forecast strong, gusty surface winds of 25 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	16	2	18
Nonoccurrences	3	112	115
TOTAL	19	114	133

Skill Score = .84
Percent Correct =96

DYESS AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	GJT 500-mb height (Time T-12)*		
(b)	GJT 500-mb height (Time T)*		
(c)	GJT 12-hour, 500-mb height change		
(d)	ELP 500-mb height (Time T-12)		
(e)	ELP 500-mb height (Time T)		
(f)	ELP 12-hour, 500-mb height change		
(g)	ELP 700-mb wind direction		
(h)	LIT 700-mb wind direction		
(i)	Difference in 700-mb wind direction from ELP to LIT (veering +, backing -)		
(j)	SAT 700-mb wind direction		
(k)	OKC 700-mb wind direction		
(l)	Difference in 700-mb wind direction from SAT to OKC (veering +, backing -)		
(m)	OKC 850-mb wind direction		
(n)	OKC 500-mb wind direction		
(o)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		
(p)	ELP 850-mb wind direction		
(q)	ELP 500-mb wind direction		
(r)	ELP directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		

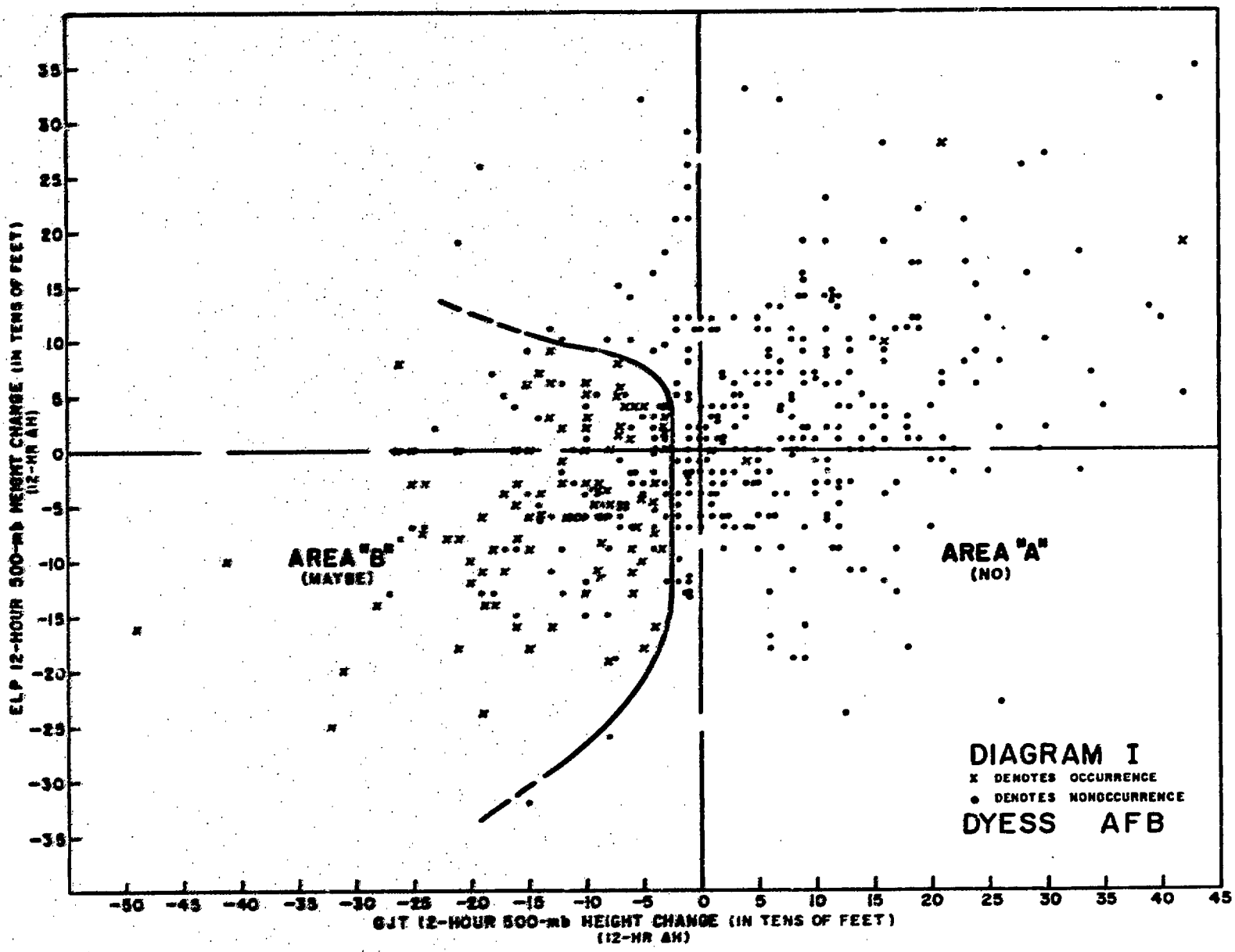
* Times are either 0000Z or 1200Z; T is current observation; T-12 is observation 12 hours previous.

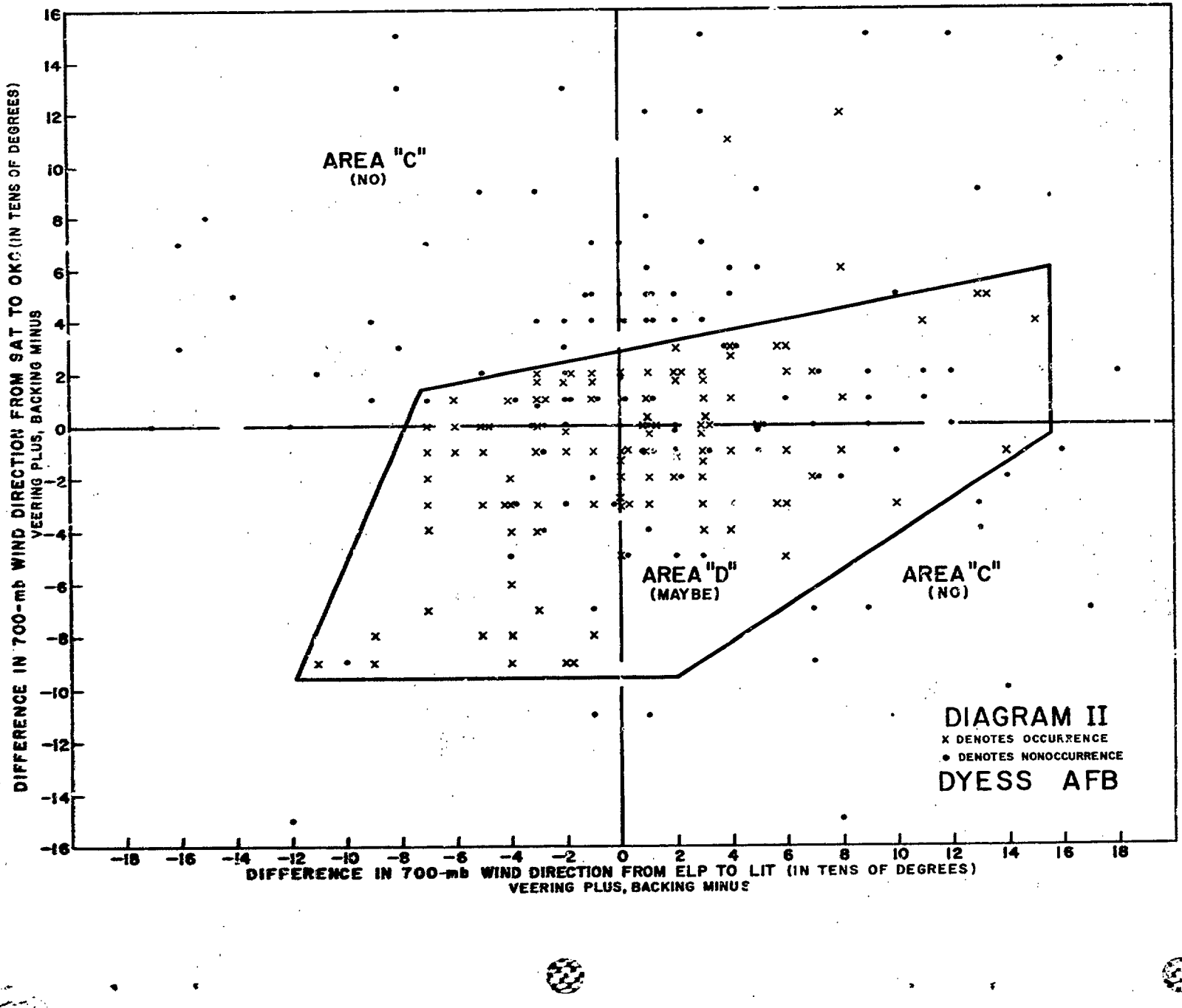
SCATTER-DIAGRAM PROCEDURE

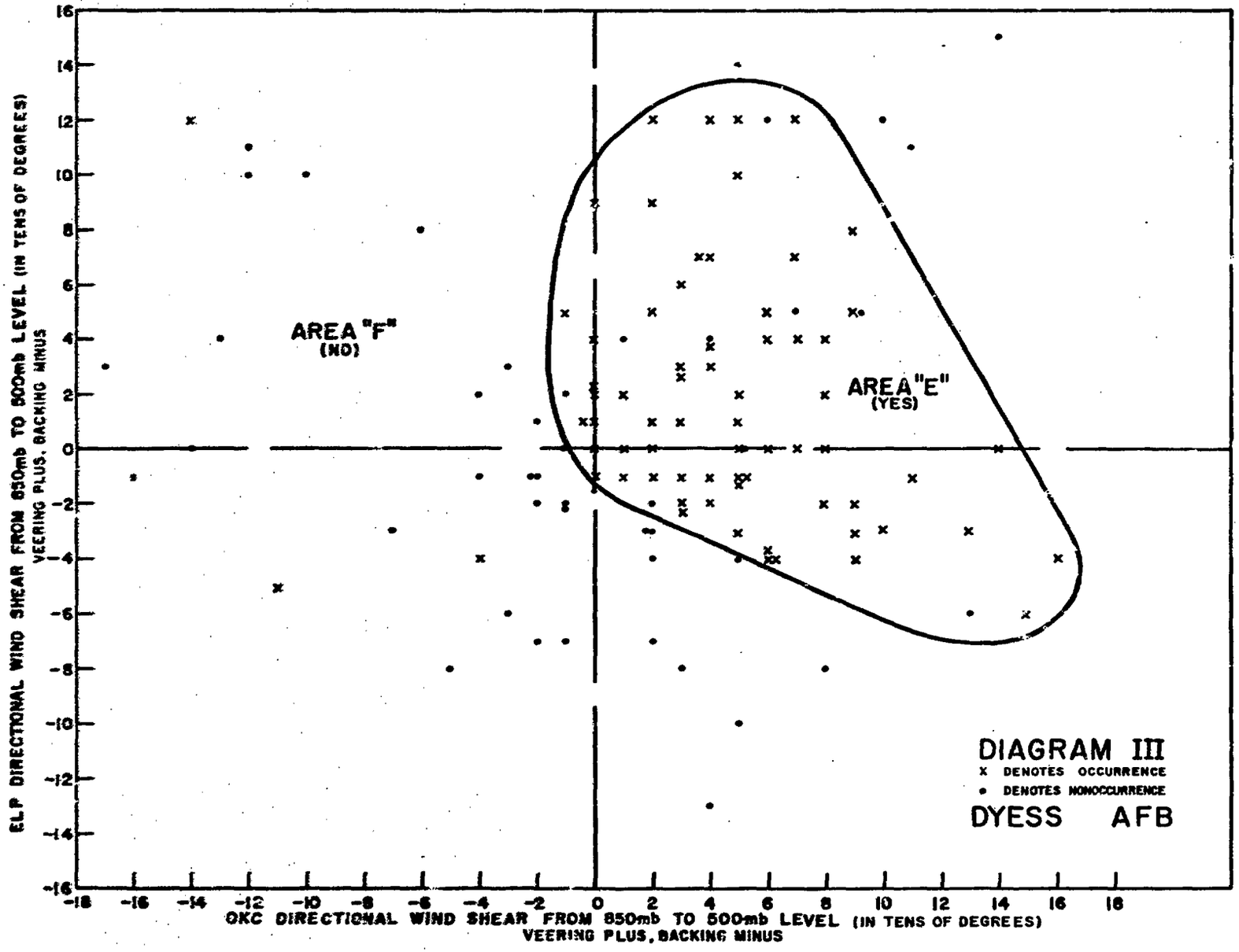
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. _____

3. With values from Items (o) and (r) enter Diagram III.
   If point falls in Area "E," forecast "Yes." _____
   If point falls in Area "F," forecast "No." _____


AREA "B"
(MAYBE)
AREA "A"
(NO)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
DYESS AFB
ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12-HR ΔH)
GJT 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12-HR ΔH)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-50 -45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45


AREA "C"
(NO)
AREA "D"
(MAYBE)
AREA "C"
(NO)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
DYESS AFB
DIFFERENCE IN 700-mb WIND DIRECTION FROM SAT TO OKC (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
DIFFERENCE IN 700-mb WIND DIRECTION FROM ELP TO LIT (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
18


AREA "F"
(NO)
AREA "E"
(YES)
DIAGRAM III
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
DYESS AFB
ELP DIRECTIONAL WIND SHEAR FROM 850mb TO 500mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
OKC DIRECTIONAL WIND SHEAR FROM 850mb TO 500mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS

3.5. WEBB AIR FORCE BASE, TEXAS

Problem: To forecast strong, gusty surface winds of 25 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	20	0	20
Nonoccurrences	3	116	119
TOTAL	23	116	139

Skill Score = .92
Percent Correct = 98

WEBB AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	GJT 500-mb height (Time T-12)*	_____	
(b)	GJT 500-mb height (Time T)*	_____	
(c)	GJT 12-hour, 500-mb height change		_____
(d)	ELP 500-mb height (Time T-12)	_____	
(e)	ELP 500-mb height (Time T)	_____	
(f)	ELP 12-hour, 500-mb height change		_____
(g)	OKC 850-mb wind direction	_____	
(h)	OKC 500-mb wind direction	_____	
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		_____
(j)	ELP 850-mb wind direction	_____	
(k)	ELP 500-mb wind direction	_____	
(l)	ELP directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		_____
(m)	LAS 500-mb height (Time T-12)	_____	
(n)	LAS 500-mb height (Time T)	_____	
(o)	LAS 12-hour, 500-mb height change		_____
(p)	SAT 850-mb wind direction	_____	
(q)	SAT 500-mb wind direction	_____	
(r)	SAT directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		_____
(s)	SAT 850-mb height	_____	
(t)	OKC 850-mb height	_____	
(u)	Item (s) minus Item (t)		_____
(v)	ELP 850-mb height	_____	
(w)	Item (v) minus Item (t)		_____

* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

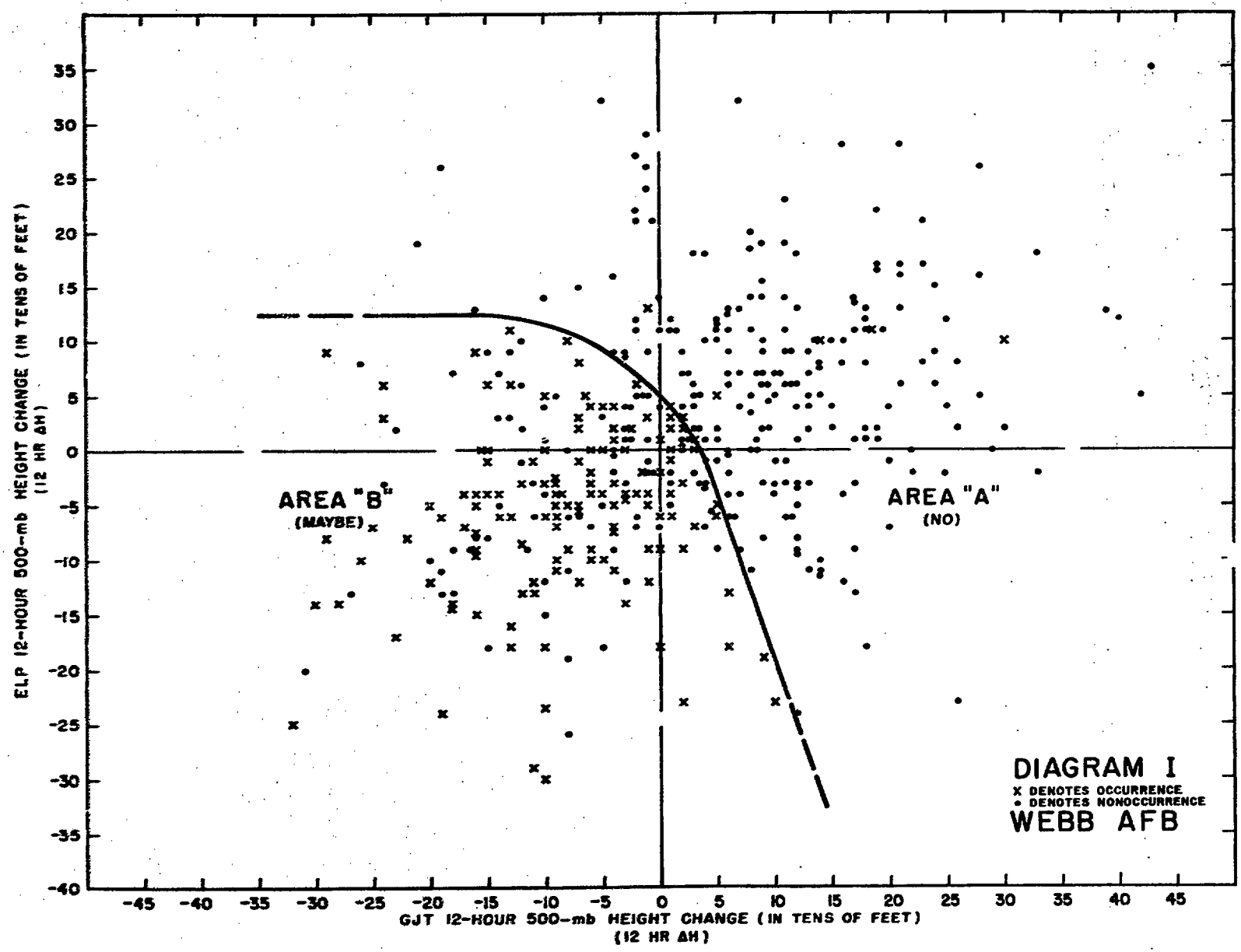
SCATTER-DIAGRAM PROCEDURE

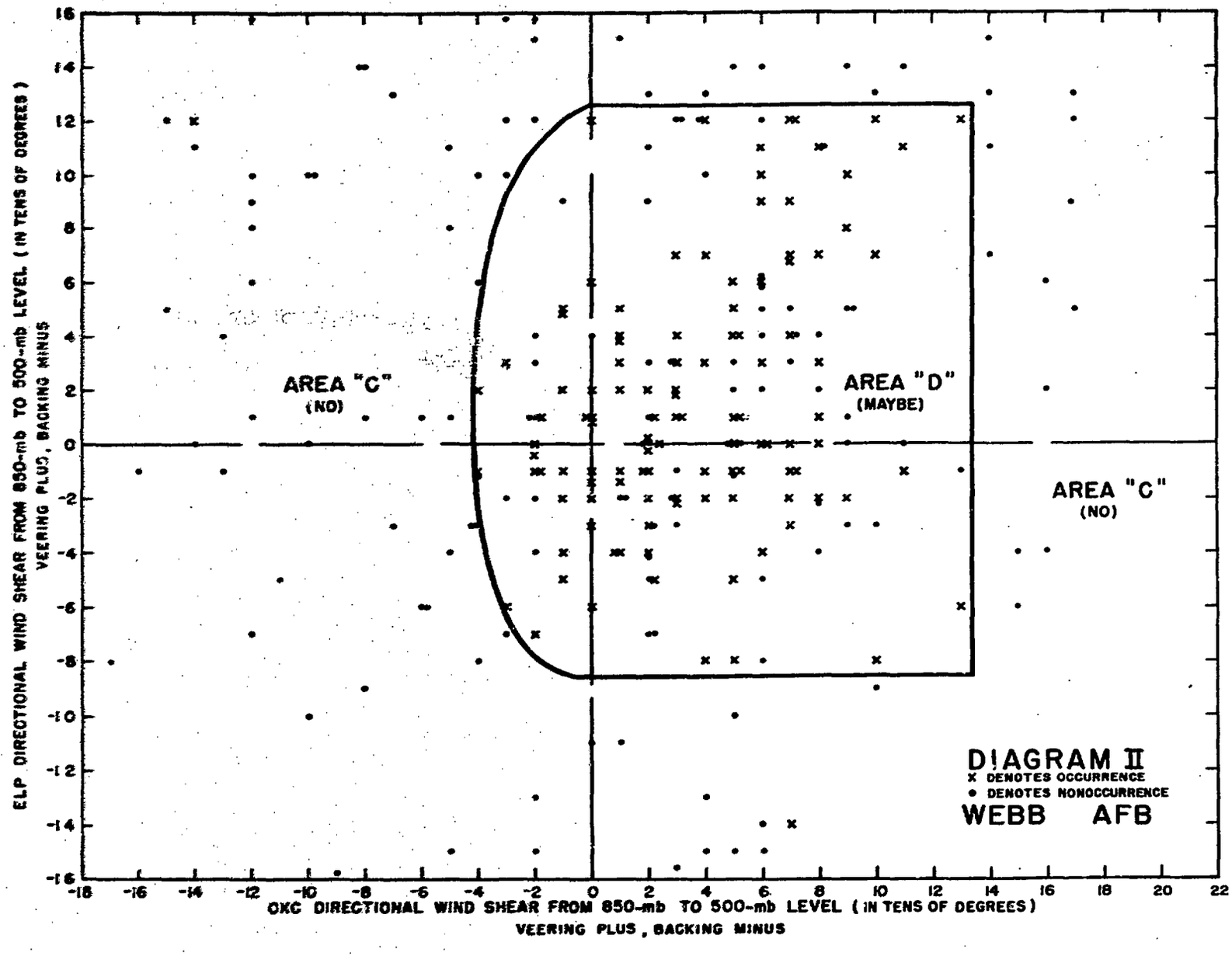
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

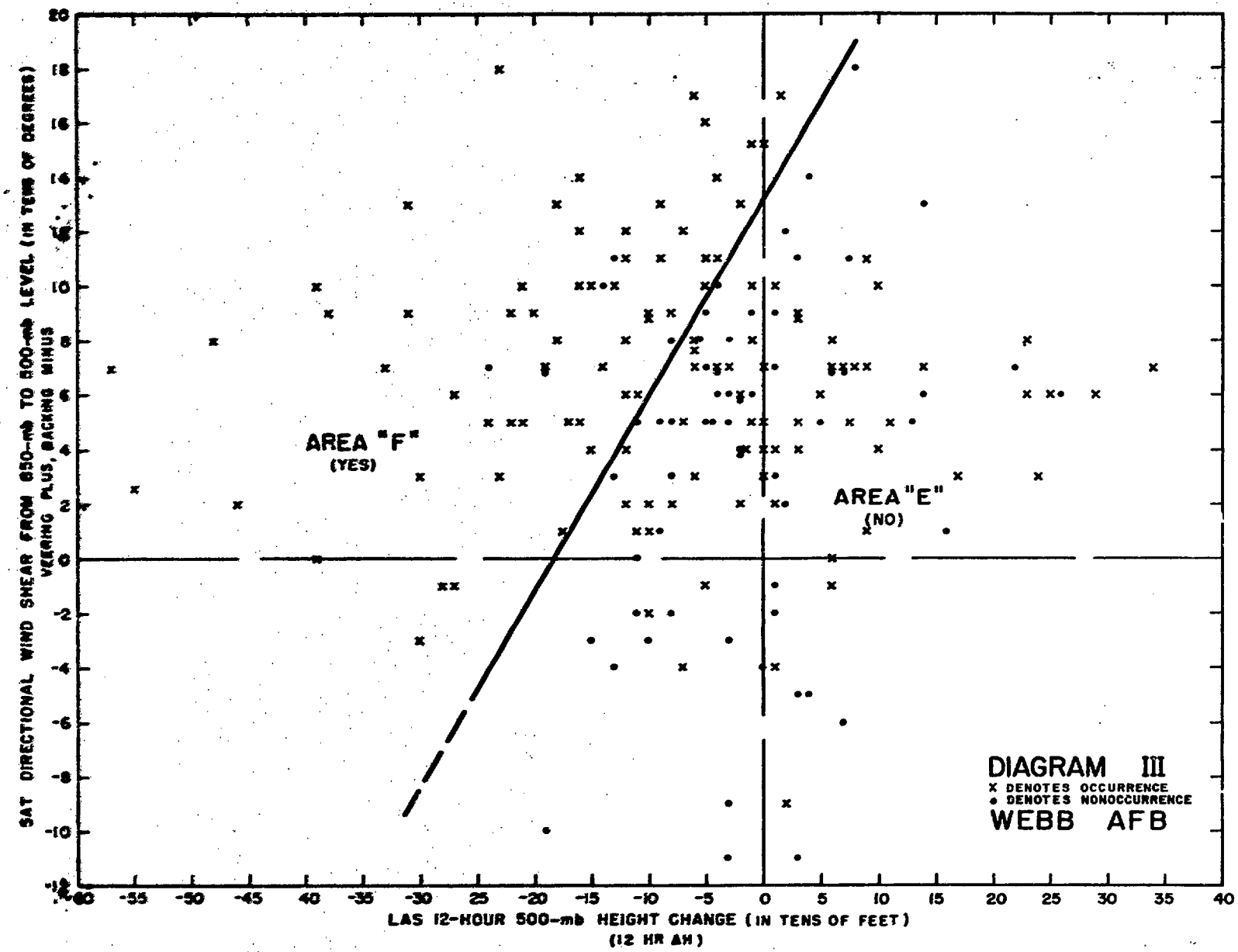
2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. _____

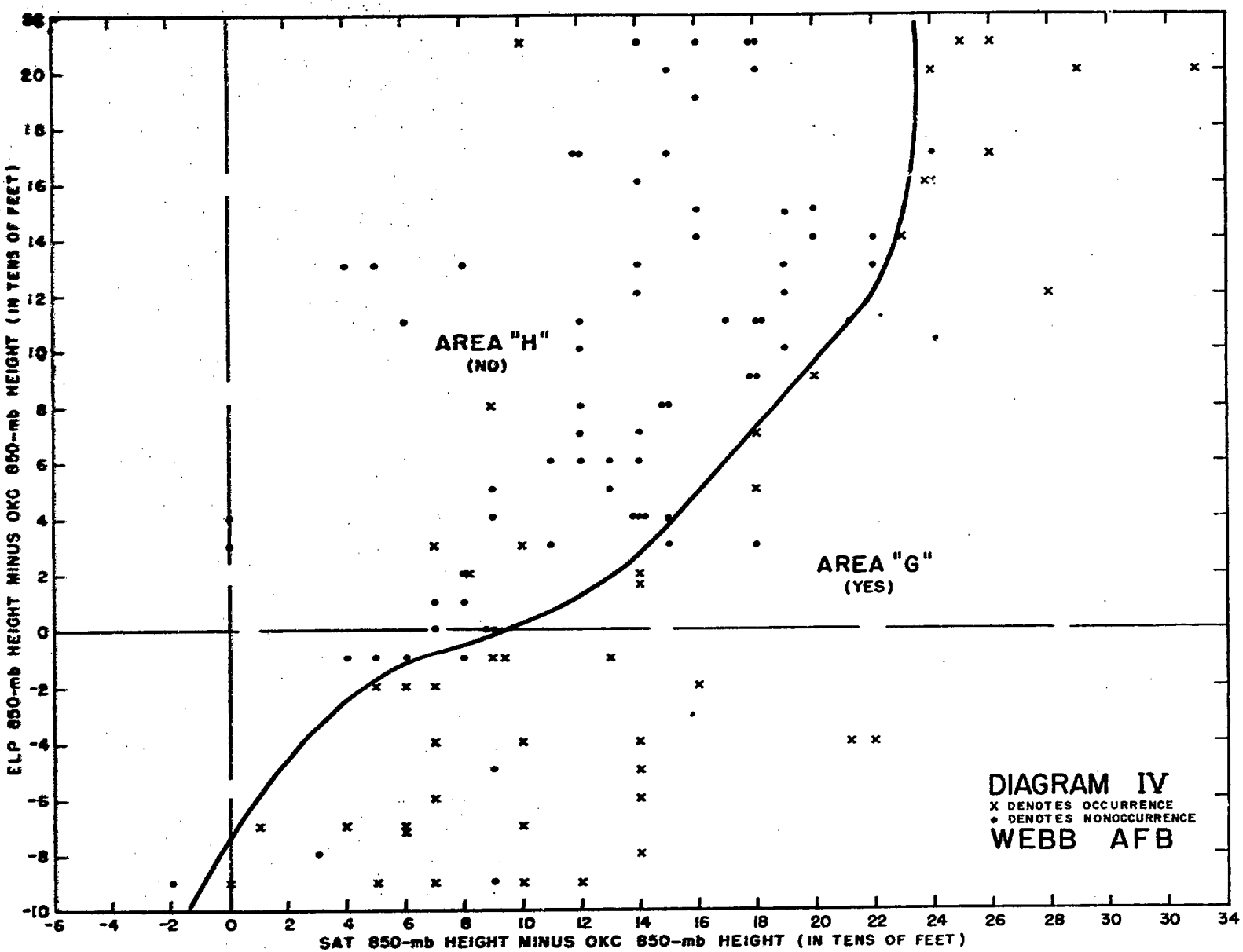
3. With values from Items (o) and (r) enter Diagram III.
   If point falls in Area "F," forecast "Yes" and stop.
   If point falls in Area "E," refer to Diagram IV. _____

4. With values from Items (u) and (w) enter Diagram IV.
   If point falls in Area "G," forecast "Yes." _____
   If point falls in Area "H," forecast "No." _____


ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
GJT 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "B"
(MAYBE)
AREA "A"
(NO)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
WEBB AFB


AREA "C"
(NO)
AREA "D"
(MAYBE)
AREA "C"
(NO)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
WEBB AFB
ELP DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
OXC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS


SAT DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
LAS 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "F"
(YES)
AREA "E"
(NO)
DIAGRAM III
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
WEBB AFB


ELP 850-mb HEIGHT MINUS OKC 850-mb HEIGHT (IN TENS OF FEET)
SAT 850-mb HEIGHT MINUS OKC 850-mb HEIGHT (IN TENS OF FEET)
AREA "H"
(NO)
AREA "G"
(YES)
DIAGRAM IV
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
WEBB AFB

3.6. CARSWELL AIR FORCE BASE, TEXAS

Problem: To forecast strong, gusty surface winds of 30 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	16	2	18
Nonoccurrences	7	90	97
TOTAL	23	92	115

Skill Score = .74
Percent Correct = 92

CARSWELL AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

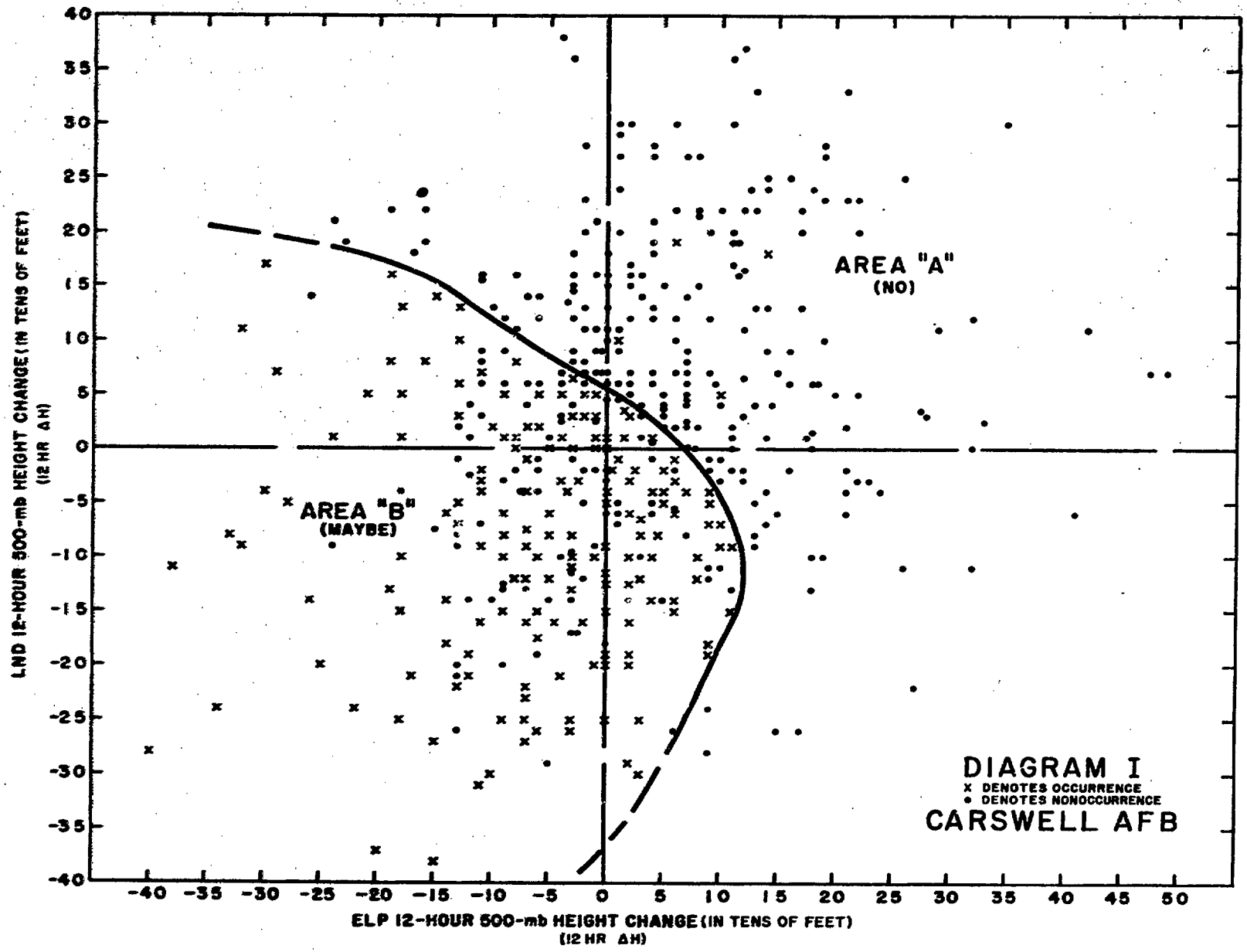
Items	Data Required	Values	
(a)	ELP 500-mb height (Time T-12)*	_____	
(b)	ELP 500-mb height (Time T)*	_____	
(c)	ELP 12-hour, 500-mb height change		_____
(d)	LND 500-mb height (Time T-12)	_____	
(e)	LND 500-mb height (Time T)	_____	
(f)	LND 12-hour, 500-mb height change		_____
(g)	OKC 850-mb wind direction	_____	
(h)	OKC 500-mb wind direction	_____	
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		_____
(j)	LAS 500-mb height (Time T-12)	_____	
(k)	LAS 500-mb height (Time T)	_____	
(l)	LAS 12-hour, 500-mb height change		_____

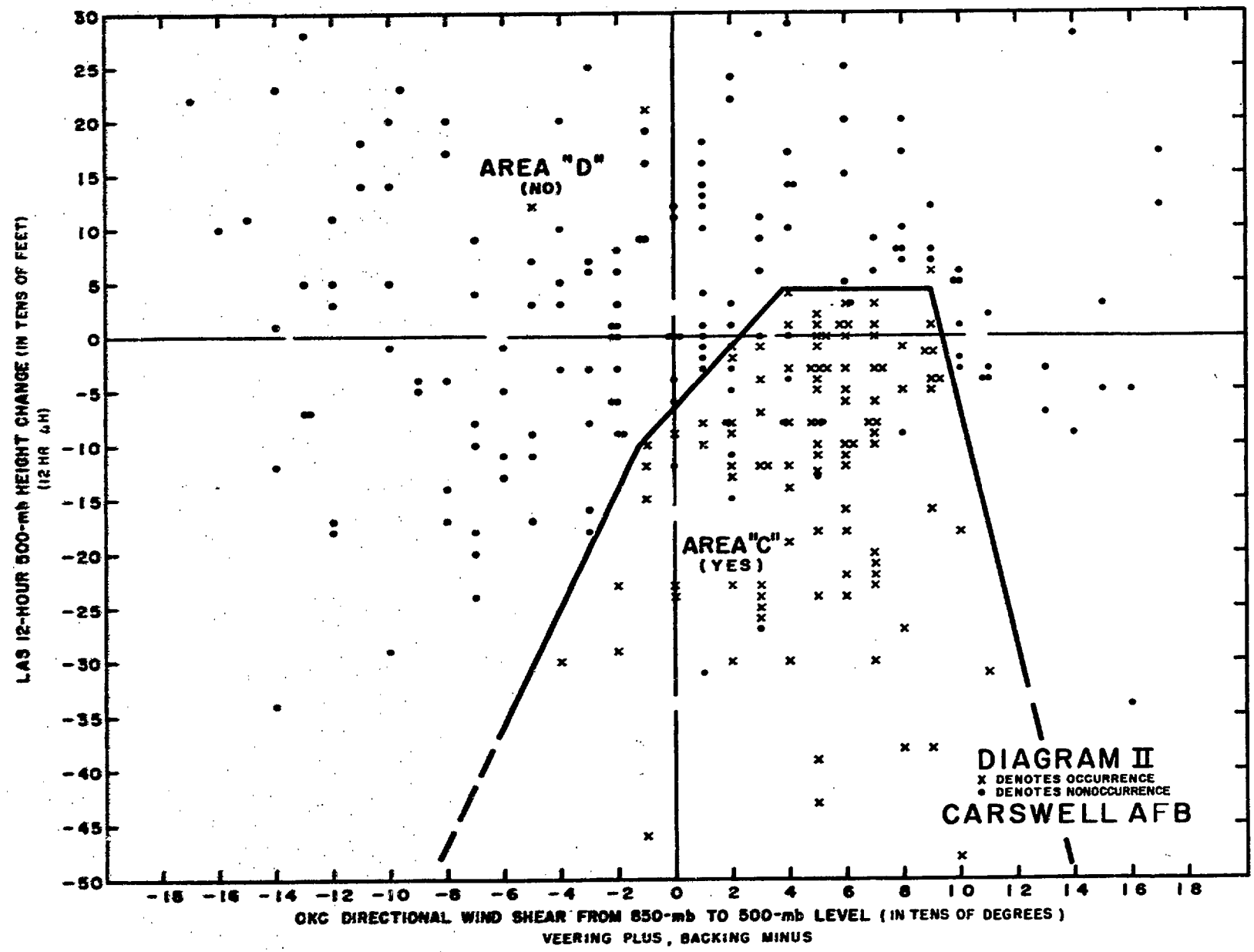
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

SCATTER-DIAGRAM PROCEDURE

1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "Yes." _____
   If point falls in Area "D," forecast "No." _____


AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
x DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
CARSWELL AFB
LND 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50


AREA "D"
(NO)
AREA "C"
(YES)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
CARSWELL AFB
LAS 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
OKC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18

3.7. BIGGS AIR FORCE BASE, TEXAS

Problem: To forecast strong, gusty surface winds of 30 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	6	3	9
Nonoccurrences	2	63	65
TOTAL	8	66	74

Skill Score = .67
Percent Correct = 93

BIGGS AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	GJT 500-mb height (Time T-12)*		
(b)	GJT 500-mb height (Time T)*		
(c)	GJT 12-hour, 500-mb height change		
(d)	ELP 500-mb height (Time T-12)		
(e)	ELP 500-mb height (Time T)		
(f)	ELP 12-hour, 500-mb height change		
(g)	LAS 700-mb wind direction		
(h)	ELP 700-mb wind direction		
(i)	Difference in 700-mb wind direction from LAS to ELP (veering +, backing -)		
(j)	LAS 850-mb wind direction		
(k)	LAS 500-mb wind direction		
(l)	LAS directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		
(m)	LAS 500-mb height (Time T-12)		
(n)	LAS 500-mb height (Time T)		
(o)	LAS 12-hour, 500-mb height change		
(p)	Item (e) minus Item (n)		

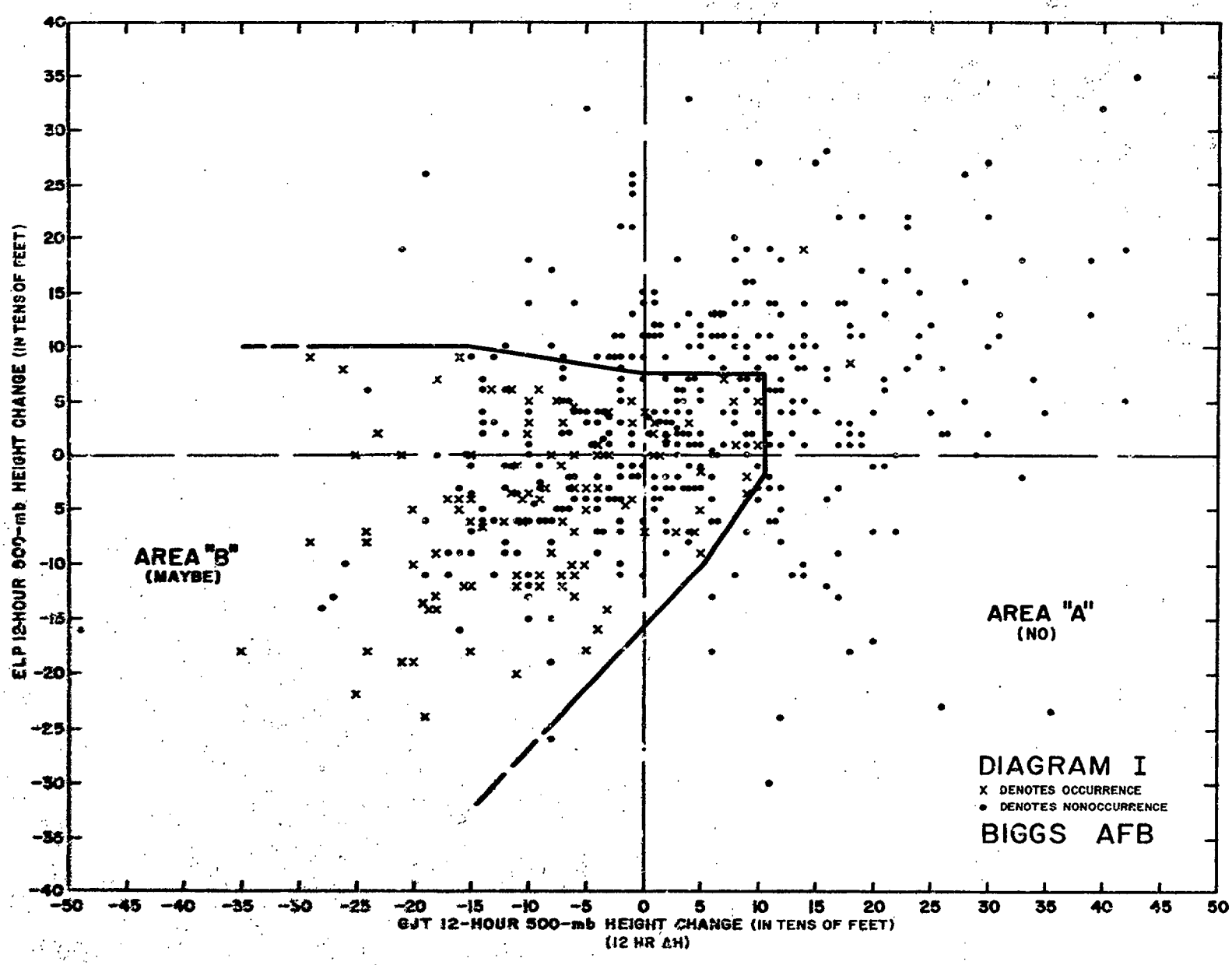
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

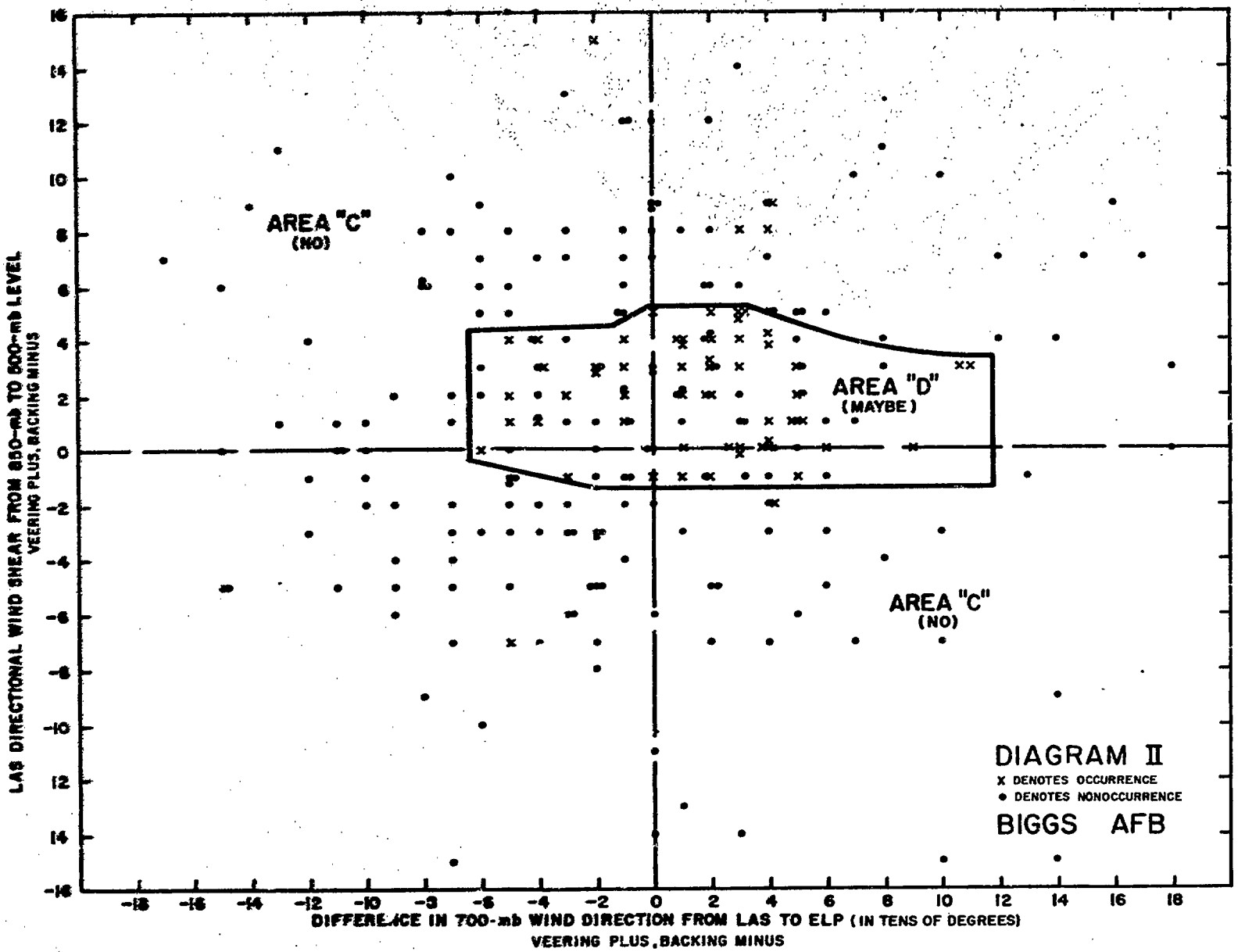
SCATTER-DIAGRAM PROCEDURE

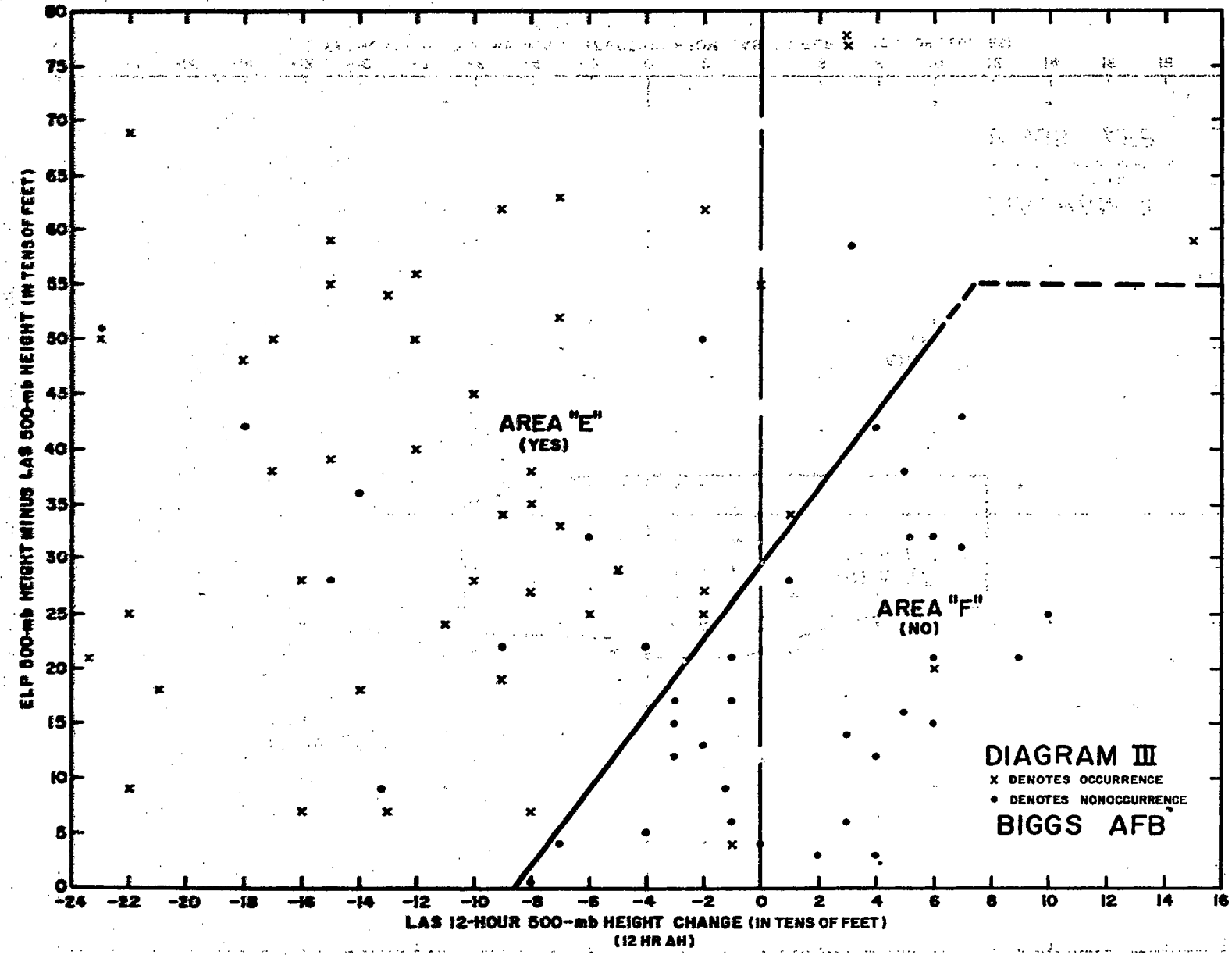
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. _____

3. With values from Items (o) and (p) enter Diagram III.
   If point falls in Area "E," forecast "Yes." _____
   If point falls in Area "F," forecast "No." _____


ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
GJT 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "B"
(MAYBE)
AREA "A"
(NO)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
BIGGS AFB


AREA "C"
(NO)
AREA "D"
(MAYBE)
AREA "C"
(NO)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
BIGGS AFB
LAS DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL
VEERING PLUS, BACKING MINUS
DIFFERENCE IN 700-mb WIND DIRECTION FROM LAS TO ELP (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS


ELP 500-mb HEIGHT MINUS LAS 500-mb HEIGHT (IN TENS OF FEET)
LAS 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "E"
(YES)
AREA "F"
(NO)
DIAGRAM III
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
BIGGS AFB

3.8. HOLLOMAN AIR FORCE BASE, NEW MEXICO

Problem: To forecast strong, gusty surface winds of 25 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	6	1	7
Nonoccurrences	1	93	94
TOTAL	7	94	101

Skill Score = .85
Percent Correct = 98

HOLLOMAN AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	GJT 500-mb height (Time T-12)*	_____	
(b)	GJT 500-mb height (Time T)*	_____	
(c)	GJT 12-hour, 500-mb height change		_____
(d)	ELP 500-mb height (Time T-12)	_____	
(e)	ELP 500-mb height (Time T)	_____	
(f)	ELP 12-hour, 500-mb height change		_____
(g)	LAS 700-mb wind direction	_____	
(h)	ELP 700-mb wind direction	_____	
(i)	Difference in 700-mb wind direction from LAS to ELP (veering +, backing -)		_____
(j)	LAS 850-mb wind direction	_____	
(k)	LAS 500-mb wind direction	_____	
(l)	LAS directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		_____
(m)	LAS 500-mb height (Time T-12)	_____	
(n)	LAS 500-mb height (Time T)	_____	
(o)	LAS 12-hour, 500-mb height change		_____
(p)	OKC 500-mb height (Time T)	_____	
(q)	Item (p) minus Item (b)		_____

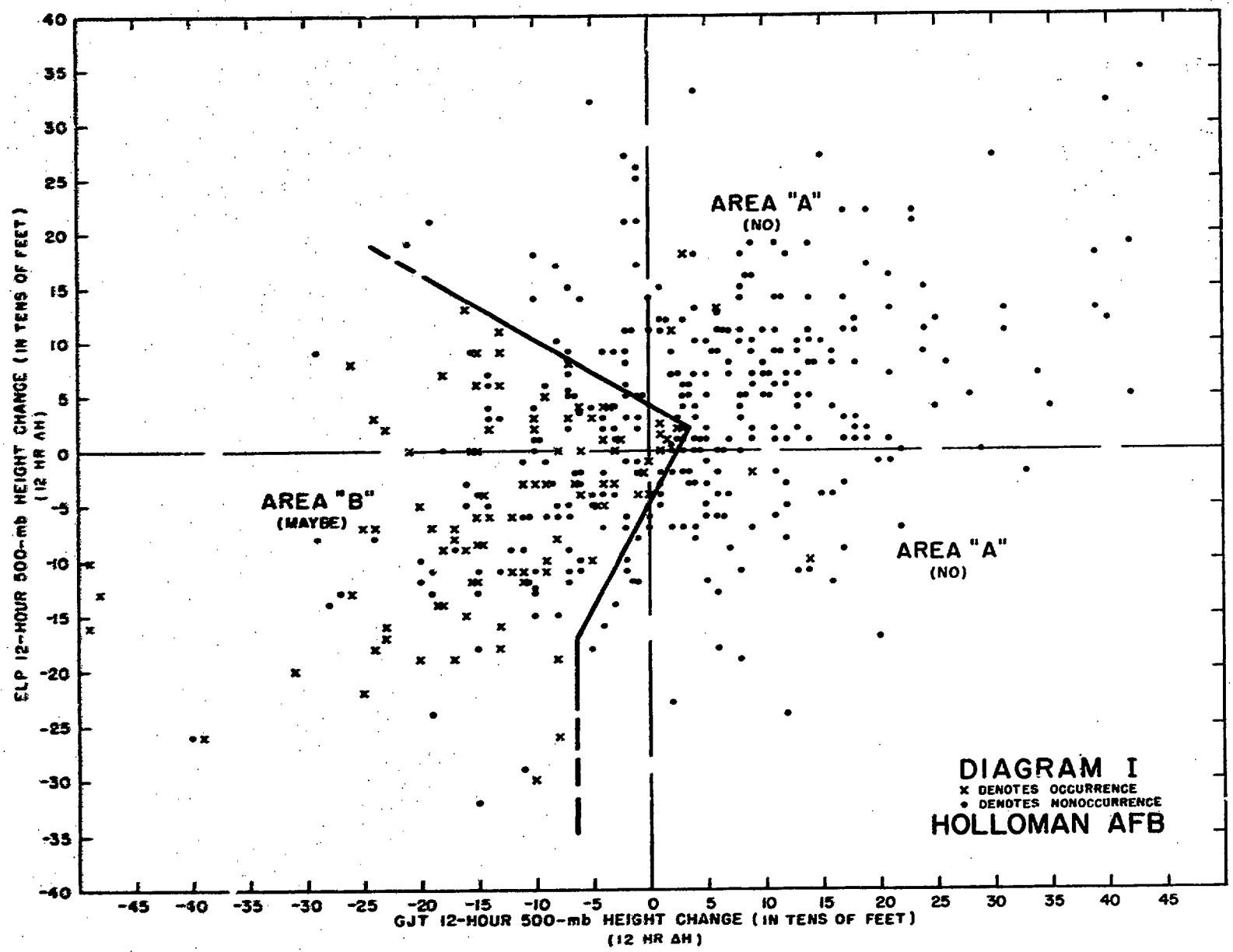
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

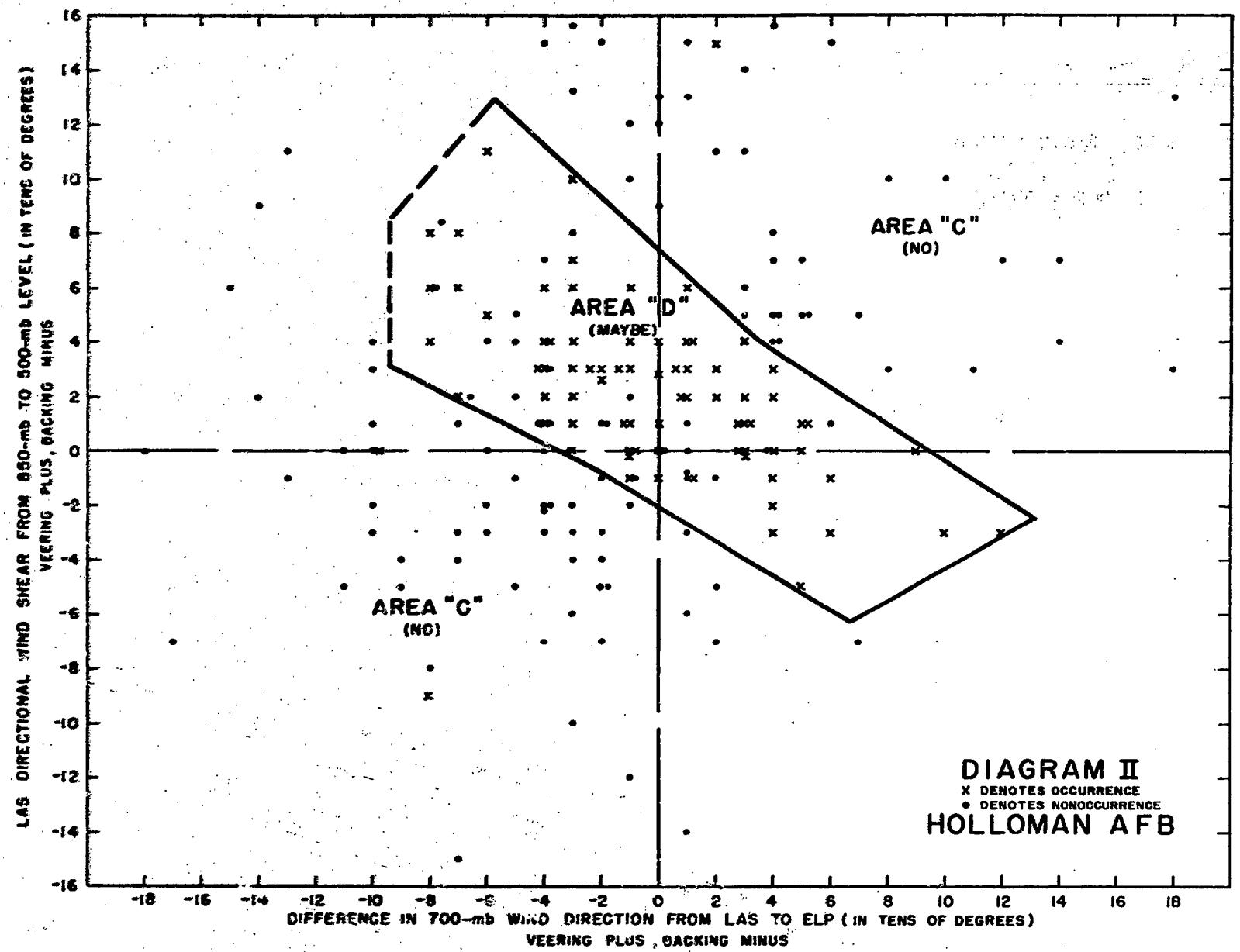
SCATTER-DIAGRAM PROCEDURE

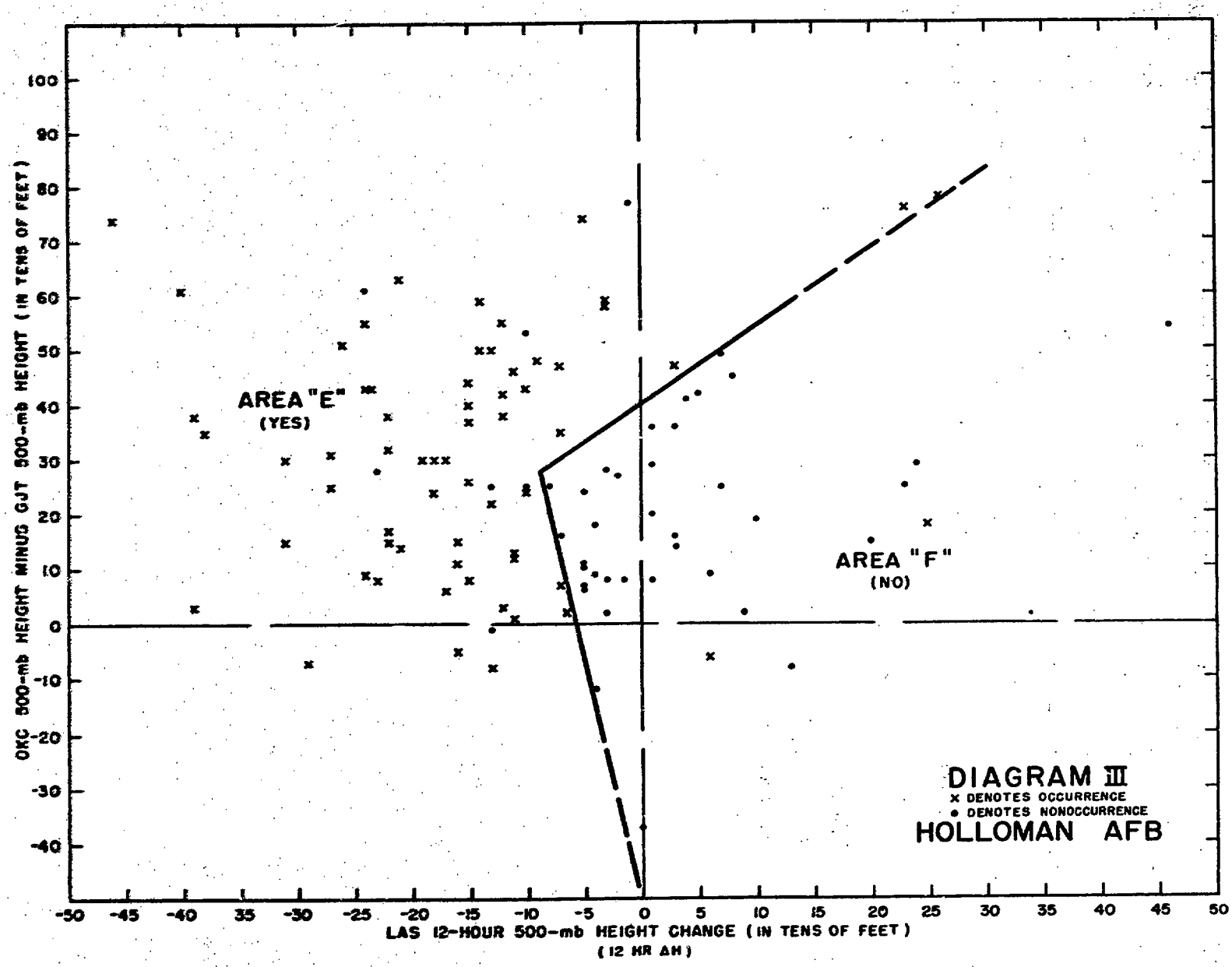
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. _____

3. With values from Items (o) and (q) enter Diagram III.
   If point falls in Area "E," forecast "Yes." _____
   If point falls in Area "F," forecast "No." _____


AREA "A"
(NO)
AREA "B"
(MAYBE)
AREA "A"
(NO)
DIAGRAM I
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
HOLLOMAN AFB
ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
GJT 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)


AREA "C"
(NO)
AREA "D"
(MAYBE)
AREA "C"
(NO)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
HOLLOMAN AFB
LAS DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
DIFFERENCE IN 700-mb WIND DIRECTION FROM LAS TO ELP (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS


OKC 500-mb HEIGHT MINUS GJT 500-mb HEIGHT (IN TENS OF FEET)
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
AREA "E"
(YES)
AREA "F"
(NO)
DIAGRAM III
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
HOLLOMAN AFB
-50 -45 -40 35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50
LAS 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)

3.9. WALKER AIR FORCE BASE, NEW MEXICO

Problem: To forecast strong, gusty surface winds of 25 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	9	1	10
Nonoccurrences	2	80	82
TOTAL	11	81	92

Skill Score =. 84
Percent Correct = 97

WALKER AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	GJT 500-mb height (Time T-12)*	____	
(b)	GJT 500-mb height (Time T)*	____	
(c)	GJT 12-hour, 500-mb height change		____
(d)	ELP 500-mb height (Time T-12)	____	
(e)	ELP 500-mb height (Time T)	____	
(f)	ELP 12-hour, 500-mb height change		____
(g)	LAS 700-mb wind direction	____	
(h)	ELP 700-mb wind direction	____	
(i)	Difference in 700-mb wind direction from LAS to ELP (veering +, backing -)		____
(j)	LAS 850-mb wind direction	____	
(k)	LAS 500-mb wind direction	____	
(l)	LAS directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		____
(m)	LAS 500-mb height (Time T-12)	____	
(n)	LAS 500-mb height (Time T)	____	
(o)	LAS 12-hour, 500-mb height change		____
(p)	OKC 500-mb height (Time T)	____	
(q)	Item (p) minus Item (b)		____

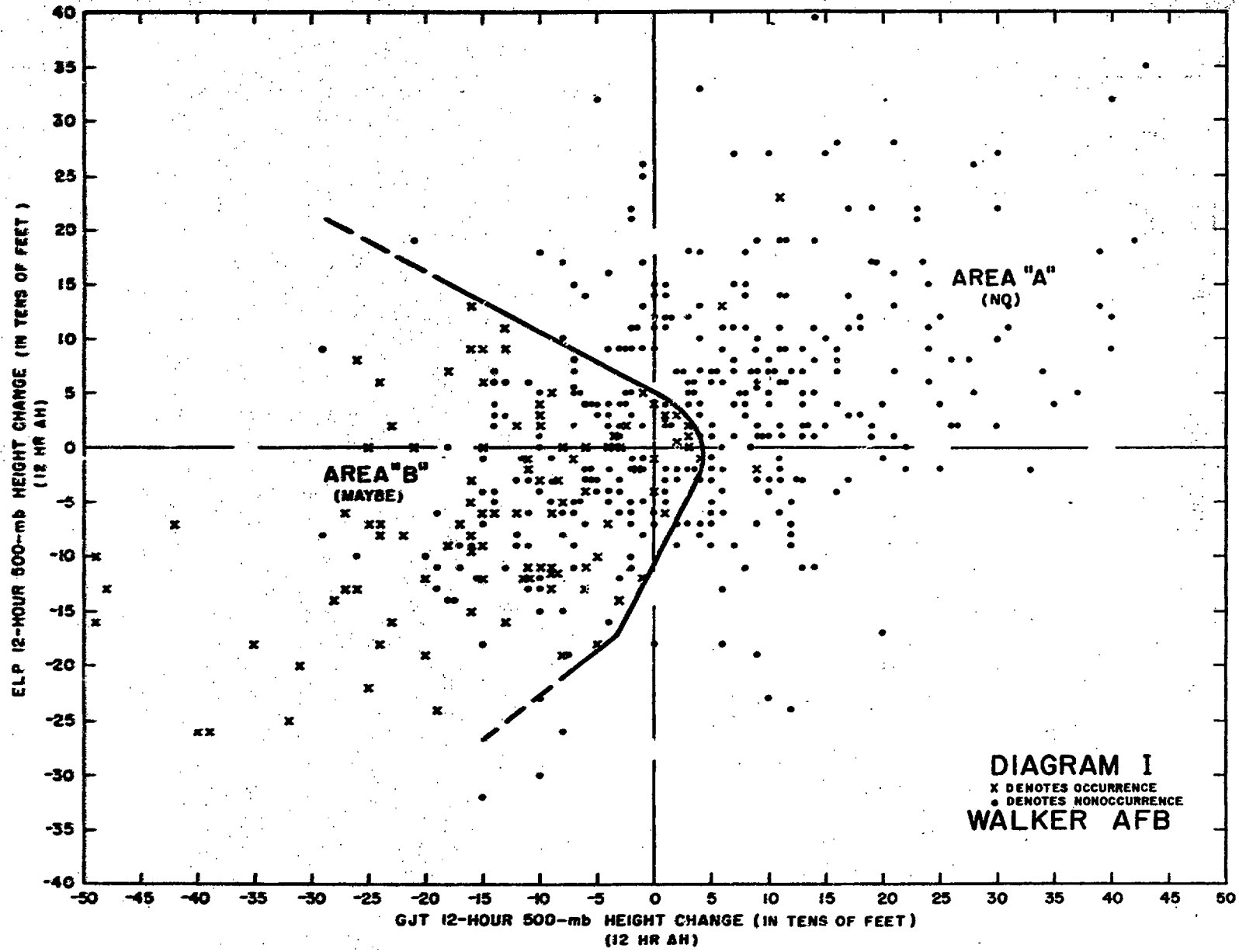
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12-hours previous.

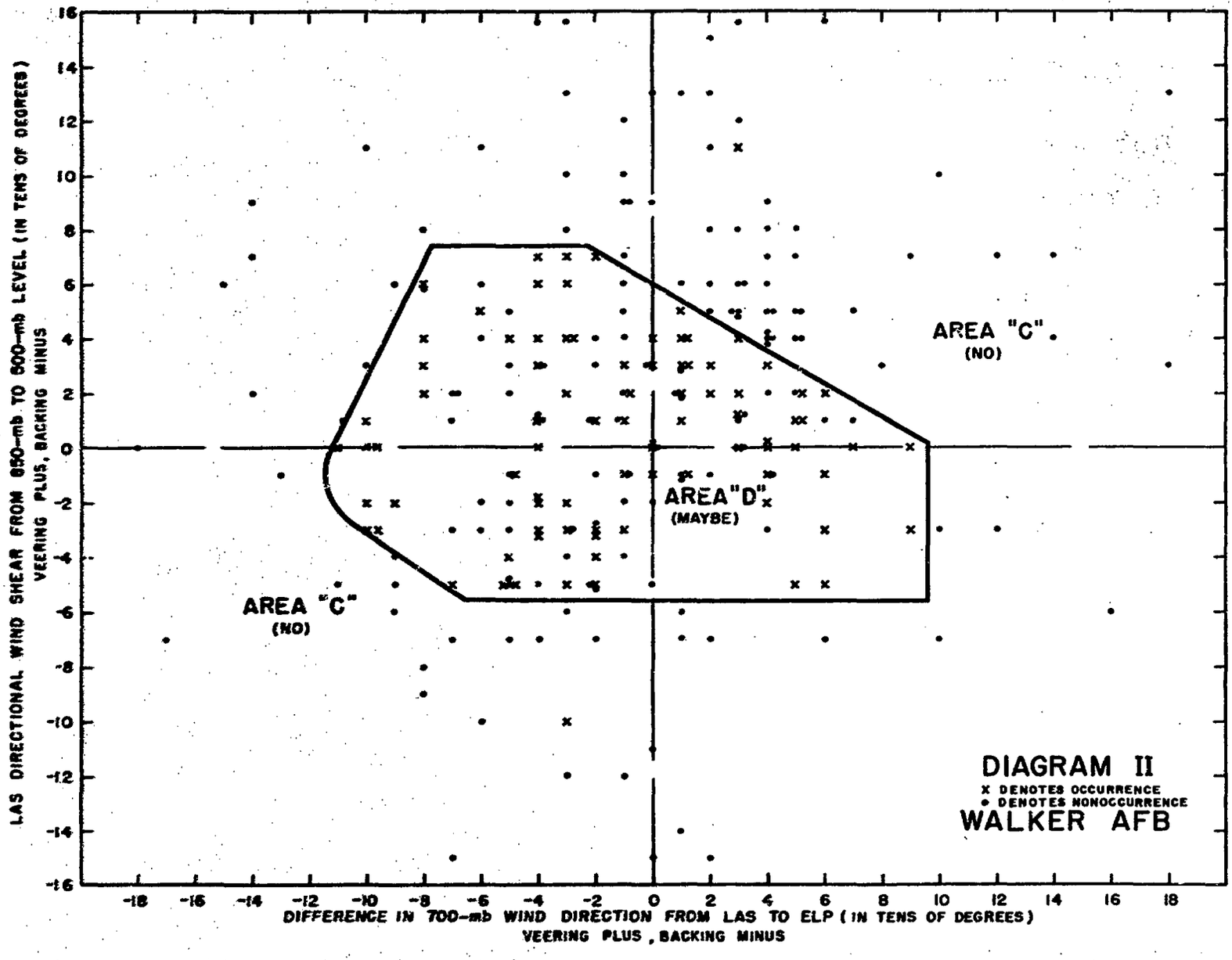
SCATTER-DIAGRAM PROCEDURE

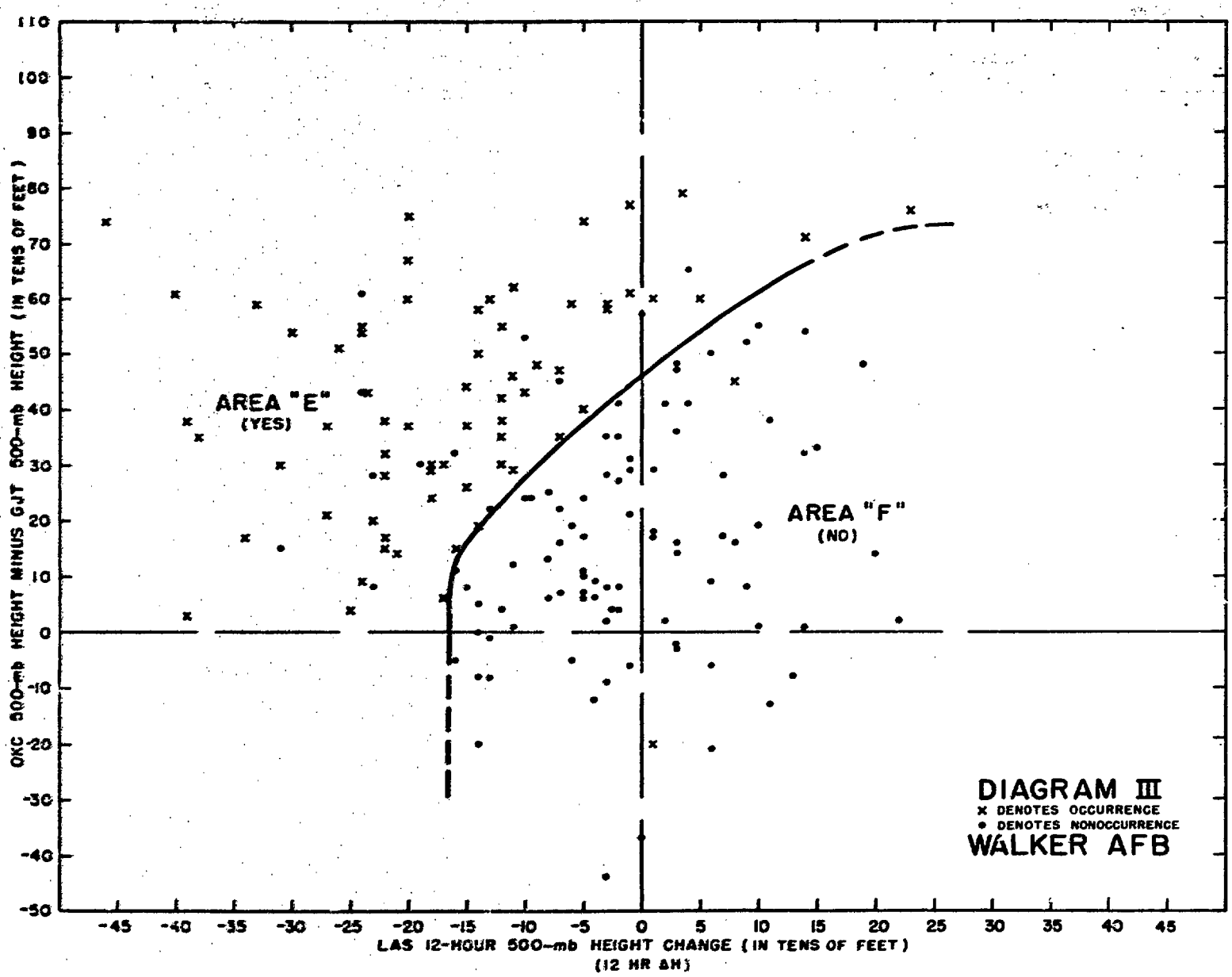
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. ____

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. ____

3. With values from Items (o) and (q) enter Diagram III.
   If point falls in Area "E," forecast "Yes." ____
   If point falls in Area "F," forecast "No." ____


ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
GJT 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
WALKER AFB


LAS DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
DIFFERENCE IN 700-mb WIND DIRECTION FROM LAS TO ELP (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
AREA "C"
(NO)
AREA "D"
(MAYBE)
AREA "C"
(NO)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
WALKER AFB


AREA "E"
(YES)
AREA "F"
(NO)
DIAGRAM III
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
WALKER AFB
OKC 500-mb HEIGHT MINUS GJT 500-mb HEIGHT (IN TENS OF FEET)
LAS 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45

3.10. CANNON AIR FORCE BASE, NEW MEXICO

Problem: To forecast strong, gusty surface winds of 30 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	27	2	29
Nonoccurrences	9	111	120
TOTAL	36	113	149

Skill Score = .78
Percent Correct = 93

CANNON AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	LND 500-mb height (Time T-12)*	____	
(b)	LND 500-mb height (Time T)*	____	
(c)	LND 12-hour, 500-mb height change		____
(d)	ELP 500-mb height (Time T-12)	____	
(e)	ELP 500-mb height (Time T)	____	
(f)	ELP 12-hour, 500-mb height change		____
(g)	OKC 850-mb wind direction	____	
(h)	OKC 500-mb wind direction	____	
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		____
(j)	Item (e) minus Item (b)		____
(k)	ELP 700-mb height (Time T)	____	
(l)	CBI 700-mb height (Time T)	____	
(m)	Item (k) minus Item (l)		____
(n)	OKC 700-mb height (Time T)	____	
(o)	LND 700-mb height (Time T)	____	
(p)	Item (n) minus Item (o)		____
(q)	CBI 500-mb height (Time T-12)	____	
(r)	CBI 500-mb height (Time T)	____	
(s)	CBI 12-hour, 500-mb height change		____
(t)	OKC 500-mb height (Time T-12)	____	
(u)	OKC 500-mb height (Time T)	____	
(v)	OKC 12-hour, 500-mb height change		____

* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

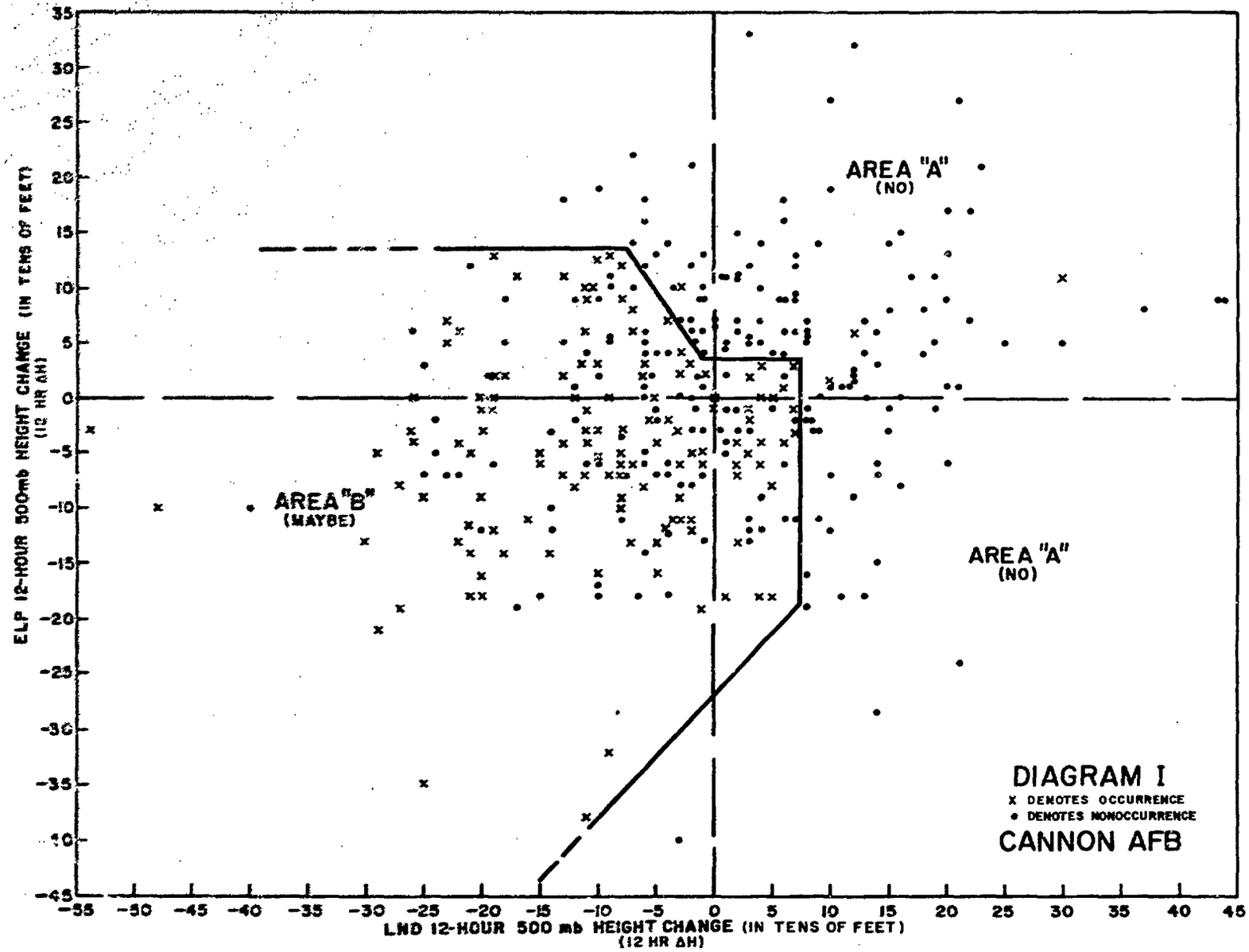
SCATTER-DIAGRAM PROCEDURE

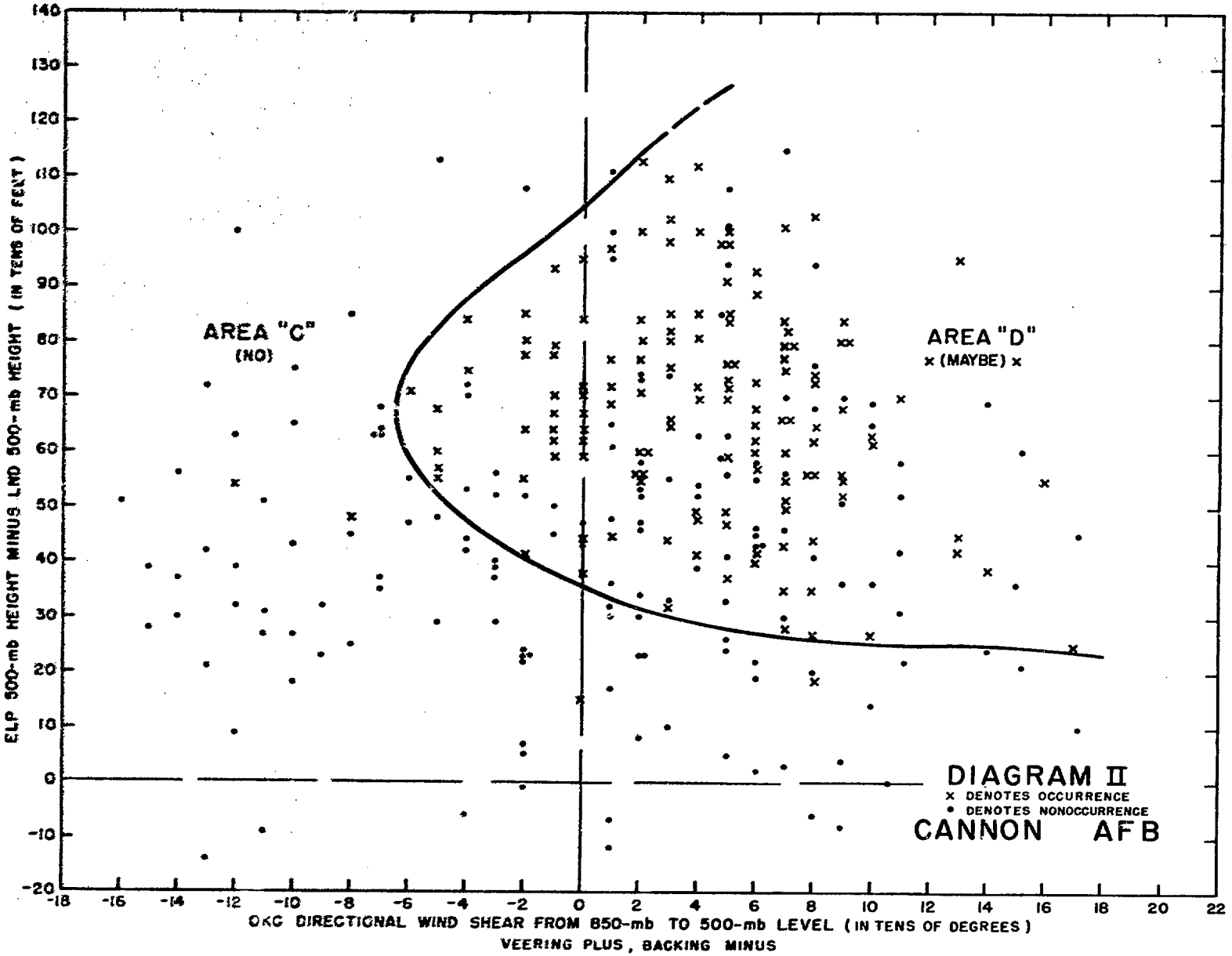
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. ____

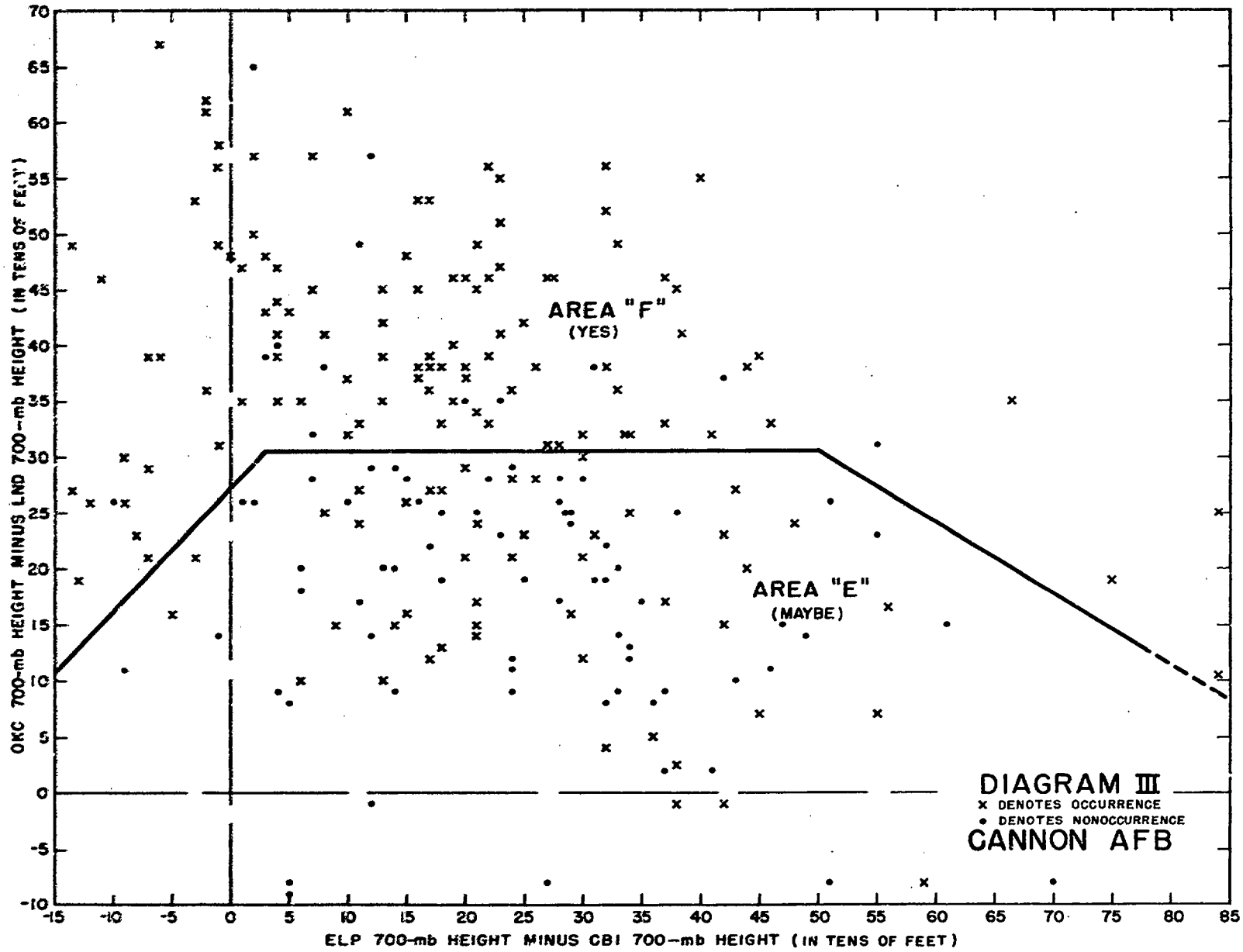
2. With values from Items (i) and (j) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. ____

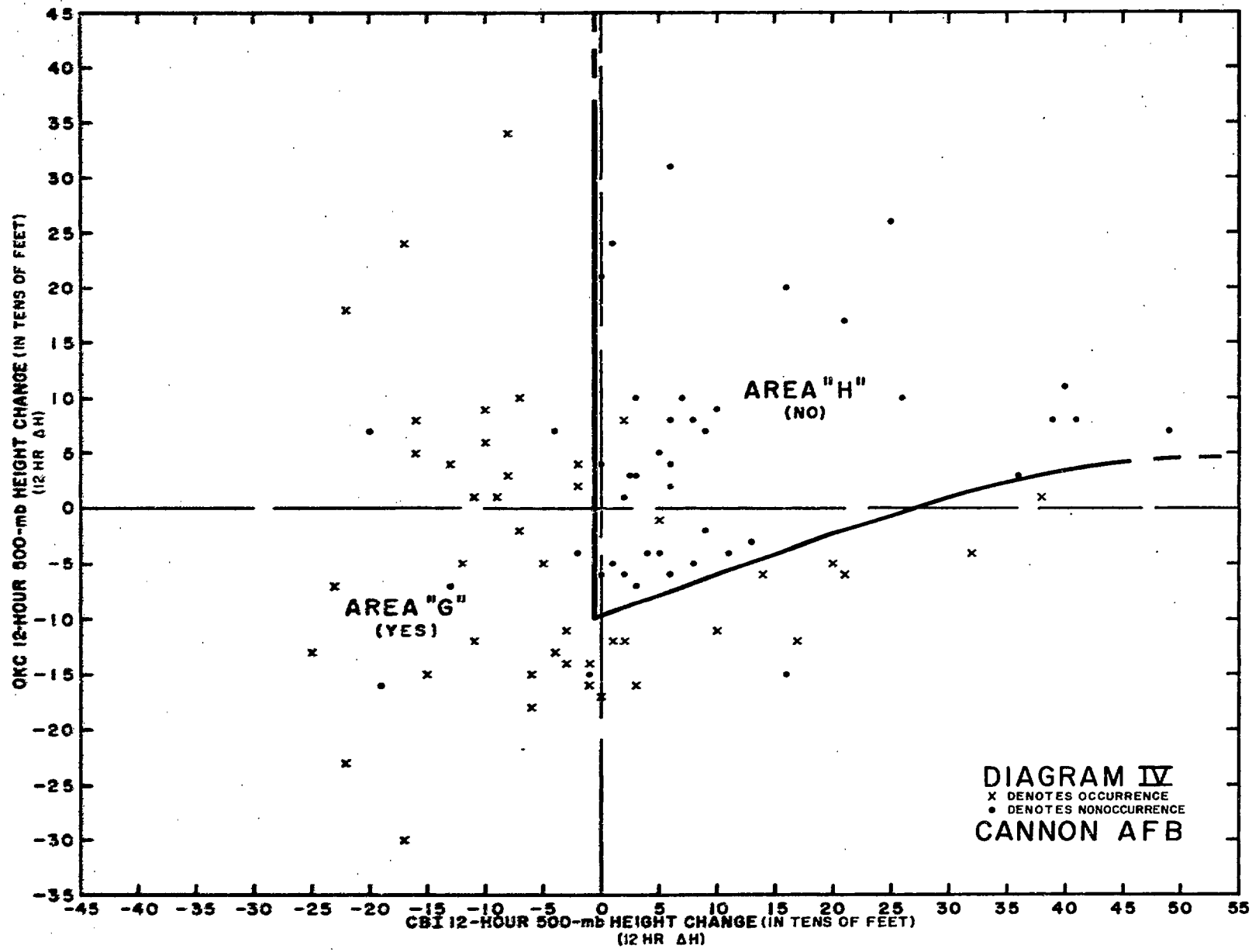
3. With values from Items (m) and (p) enter Diagram III.
   If point falls in Area "F," forecast "Yes" and stop.
   If point falls in Area "E," refer to Diagram IV. ____

4. With values from Items (s) and (v) enter Diagram IV.
   If point falls in Area "G," forecast "Yes." ____
   If point falls in Area "H," forecast "No." ____


AREA "A"
(NO)
AREA "B"
(MAYBE)
AREA "A"
(NO)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
CANNON AFB
ELP 12-HOUR 500mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
LND 12-HOUR 500 mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-55 -50 -45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45


AREA "C"
(NO)
AREA "D"
x (MAYBE) x
DIAGRAM II
x DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
CANNON AFB
ELP 500-mb HEIGHT MINUS LND 500-mb HEIGHT (IN TENS OF FEET)
OKC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-18
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
18
20
22


AREA "F"
(YES)
AREA "E"
(MAYBE)
DIAGRAM III
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
CANNON AFB
OKC 700-mb HEIGHT MINUS LND 700-mb HEIGHT (IN TENS OF FEET)
ELP 700-mb HEIGHT MINUS CBI 700-mb HEIGHT (IN TENS OF FEET)
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85


AREA "H"
(NO)
AREA "G"
(YES)
DIAGRAM IV
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
CANNON AFB
OKC 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
CBI 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55

3.11. KIRTLAND AIR FORCE BASE, NEW MEXICO

Problem: To forecast strong, gusty surface winds of 30 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	13	3	16
Nonoccurrences	3	121	124
TOTAL	16	124	140

Skill Score = .79
Percent Correct = 96

KIRTLAND AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	LND 500-mb height (Time T-12)*	____	
(b)	LND 500-mb height (Time T)*	____	
(c)	LND 12-hour, 500-mb height change		____
(d)	ELP 500-mb height (Time T-12)	____	
(e)	ELP 500-mb height (Time T)	____	
(f)	ELP 12-hour, 500-mb height change		____
(g)	LAS 500-mb height (Time T-12)	____	
(h)	LAS 500-mb height (Time T)	____	
(i)	LAS 12-hour, 500-mb height change		____
(j)	SAT 500-mb height	____	
(k)	GJT 500-mb height	____	
(l)	Item (j) minus Item (k)		____
(m)	LBF 500-mb height (Time T-12)	____	
(n)	LBF 500-mb height (Time T)	____	
(o)	LBF 12-hour, 500-mb height change		____
(p)	OKC 500-mb height	____	
(q)	Item (h) minus Item (p)		____

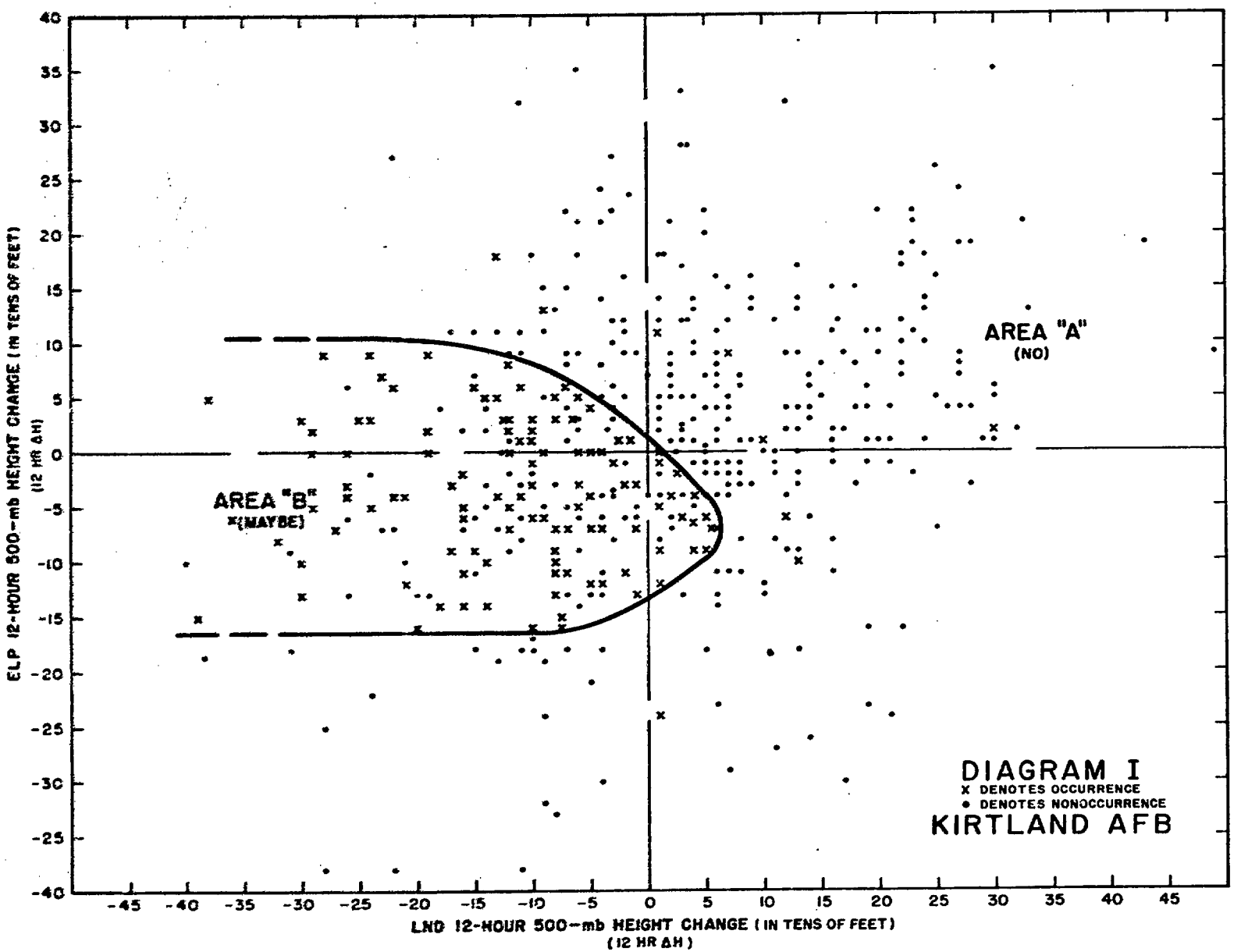
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

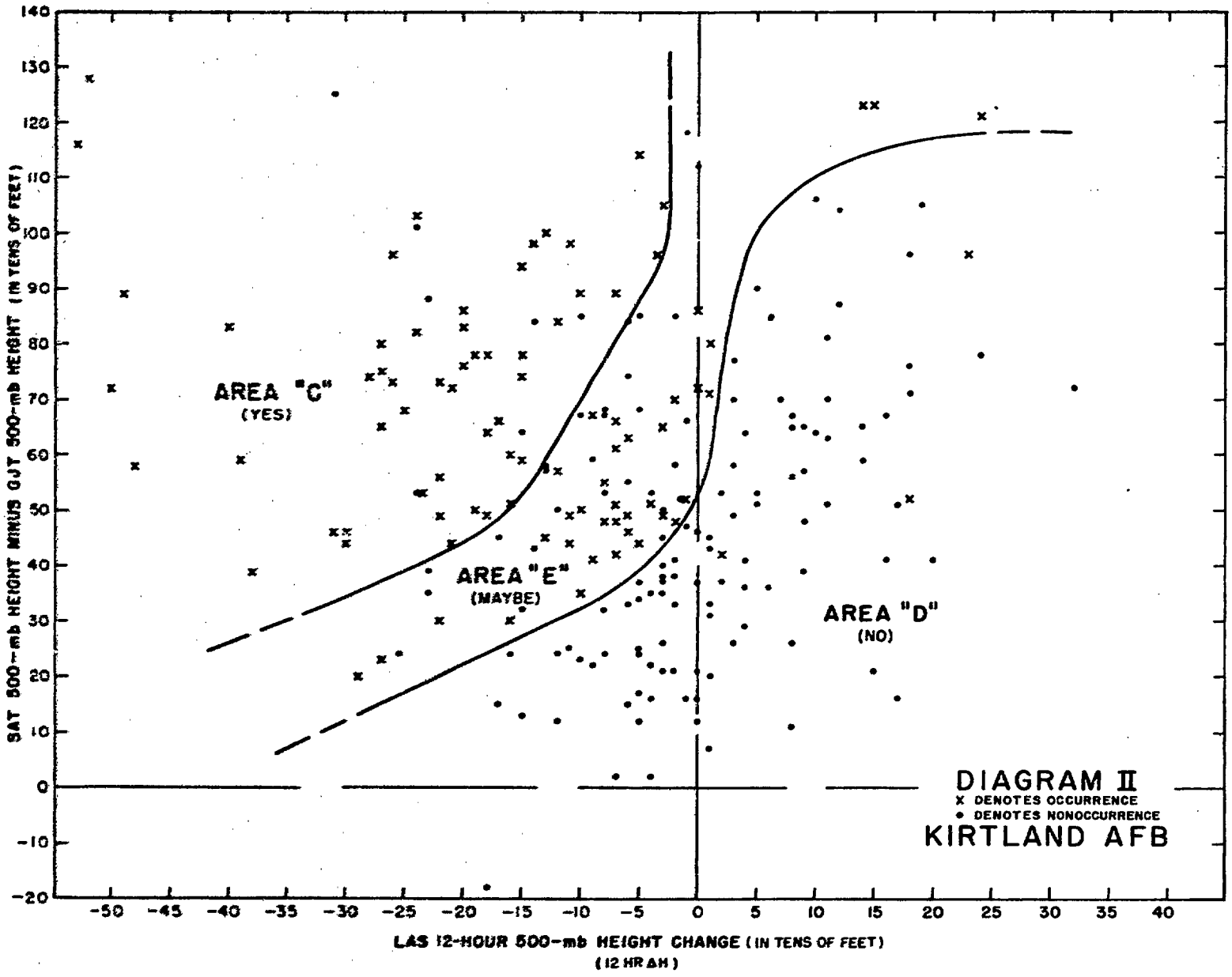
SCATTER-DIAGRAM PROCEDURE

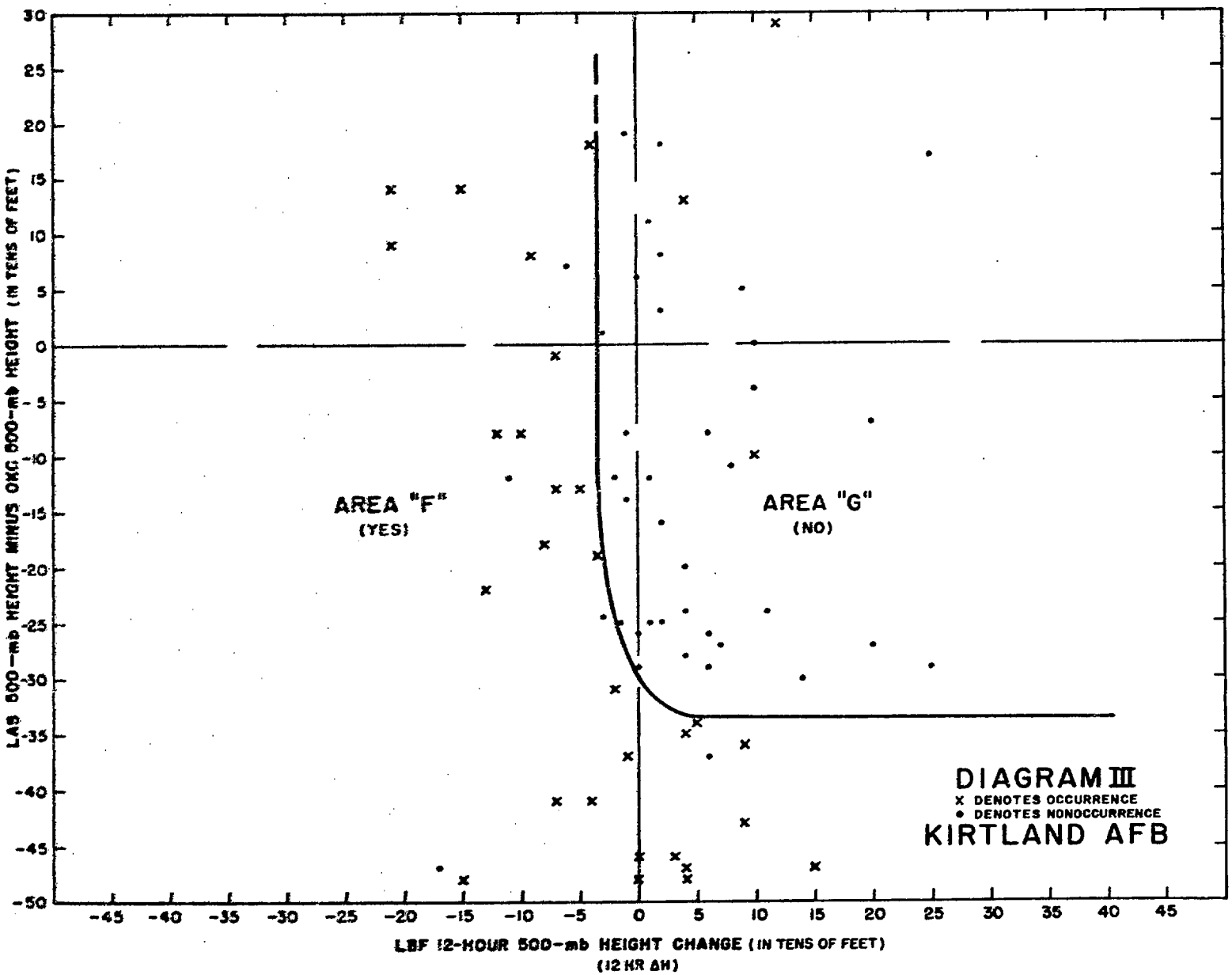
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop. ____
   If point falls in Area "B," refer to Diagram II.

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "Yes" and stop. ____
   If point falls in Area "D," forecast "No" and stop. ____
   If point falls in Area "E," refer to Diagram III.

3. With values from Items (o) and (q) enter Diagram III.
   If point falls in Area "F," forecast "Yes." ____
   If point falls in Area "G," forecast "No." ____


AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
KIRTLAND AFB
ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
LND 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
45


SAT 500-mb HEIGHT MINUS GJT 500-mb HEIGHT (IN TENS OF FEET)
LAS 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "C"
(YES)
AREA "E"
(MAYBE)
AREA "D"
(NO)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
KIRTLAND AFB


AREA "F"
(YES)
AREA "G"
(NO)
DIAGRAM III
x DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
KIRTLAND AFB
LAS 500-mb HEIGHT MINUS OKC 500-mb HEIGHT (IN TENS OF FEET)
LBF 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)

3.12. V NCE AIR FORCE BASE, OKLAHOMA

Problem: To forecast strong, gusty surface winds of 25 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	19	4	23
Nonoccurrences	2	75	77
TOTAL	21	79	100

Skill Score = .82
Percent Correct = 94

VANCE AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	GJT 500-mb height (Time T-12)*	____	
(b)	GJT 500-mb height (Time T)*	____	
(c)	GJT 12-hour, 500-mb height change		____
(d)	LAS 500-mb height (Time T-12)	____	
(e)	LAS 500-mb height (Time T)	____	
(f)	LAS 12-hour, 500-mb height change		____
(g)	OKC 850-mb wind direction	____	
(h)	OKC 500-mb wind direction	____	
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		____
(j)	ELP 500-mb height	____	
(k)	LND 500-mb height	____	
(l)	Item (j) minus Item (k)		____
(m)	SAT 500-mb height	____	
(n)	CBI 500-mb height	____	
(o)	Item (m) minus Item (n)		____
(p)	LIT 500-mb height	____	
(q)	LBF 500-mb height	____	
(r)	Item (p) minus Item (q)		____

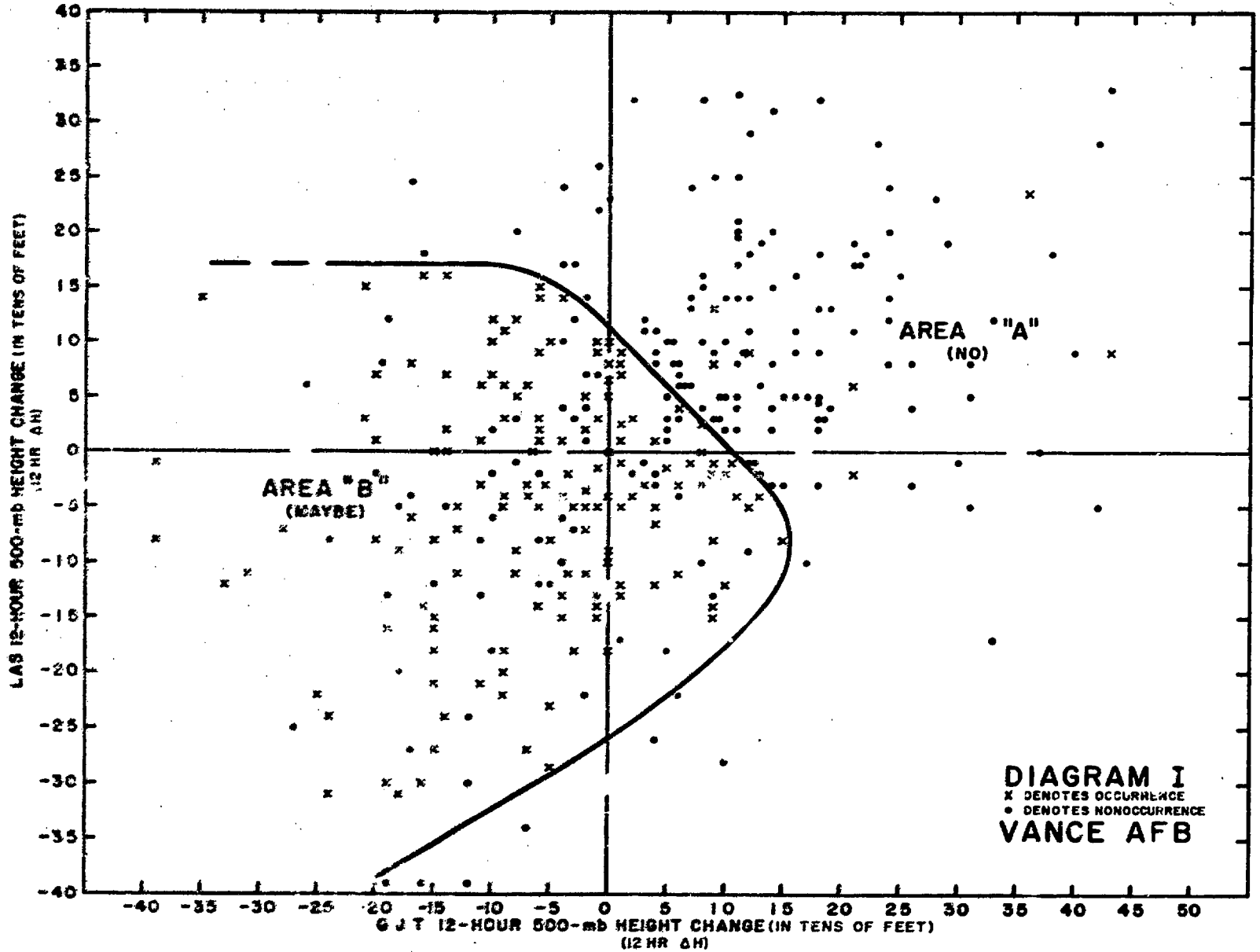
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

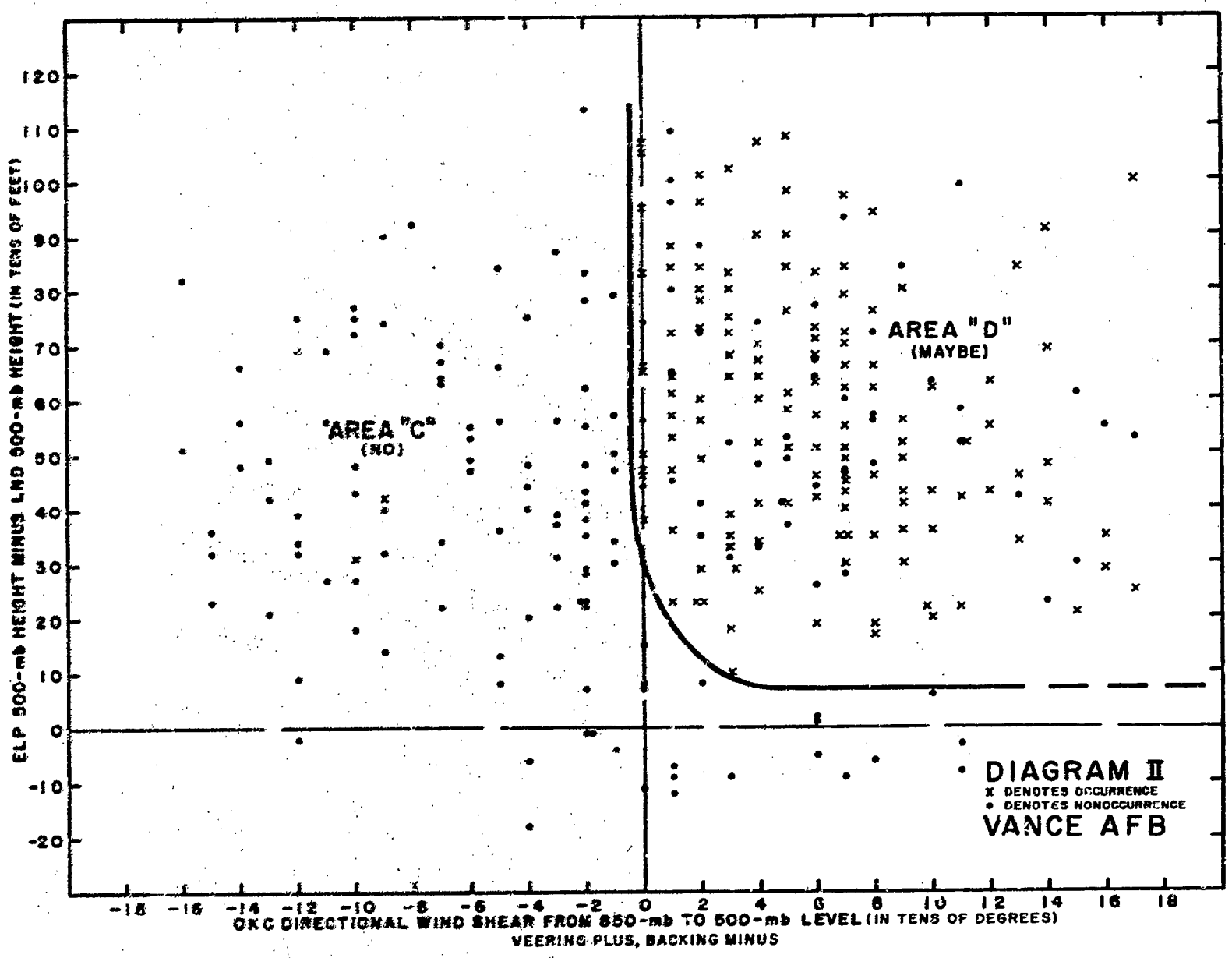
SCATTER-DIAGRAM PROCEDURE

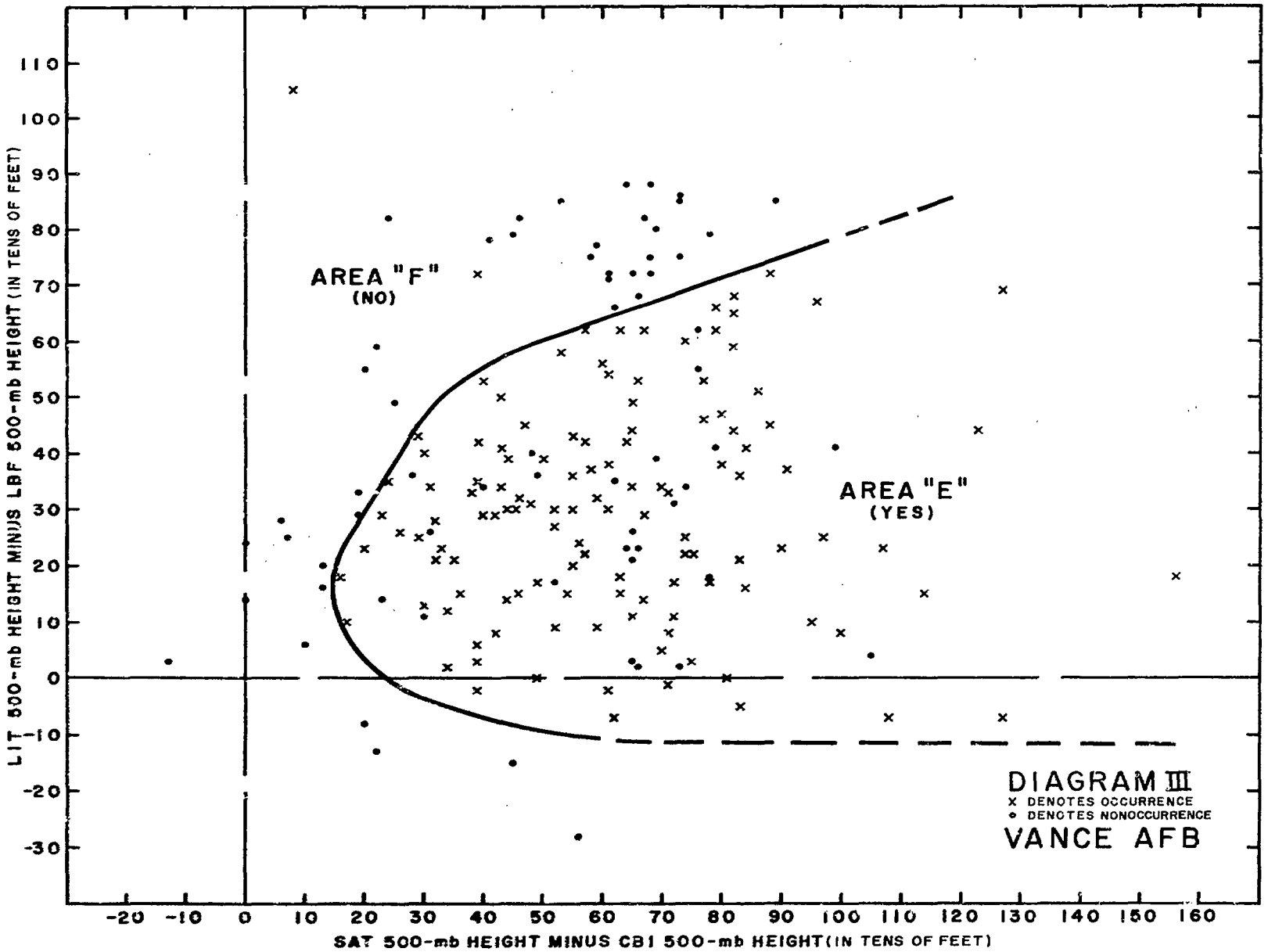
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. ____

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. ____

3. With values from Items (o) and (r) enter Diagram III.
   If point falls in Area "E," forecast "Yes." ____
   If point falls in Area "F," forecast "No." ____


AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
VANCE AFB
LAS 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
GJT 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50


ELP 500-mb HEIGHT MINUS LND 500-mb HEIGHT (IN TENS OF FEET)
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
AREA "C"
(NO)
AREA "D"
(MAYBE)
DIAGRAM II
x DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
VANCE AFB
-18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18
OKC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS


AREA "F"
(NO)
AREA "E"
(YES)
DIAGRAM III
× DENOTES OCCURRENCE
○ DENOTES NONOCCURRENCE
VANCE AFB
LIT 500-mb HEIGHT MINUS LBF 500-mb HEIGHT (IN TENS OF FEET)
SAT 500-mb HEIGHT MINUS CBI 500-mb HEIGHT (IN TENS OF FEET)
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

3.13. TINKER AIR FORCE BASE, OKLAHOMA

Problem: To forecast strong, gusty surface winds of 30 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	21	3	24
Nonoccurrences	4	79	83
TOTAL	25	82	107

Skill Score = .82
Percent Correct = 93

TINKER AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values
(a)	LND 500-mb height (Time T-12)*	_____
(b)	LND 500-mb height (Time T)*	_____
(c)	LND 12-hour, 500-mb height change	_____
(d)	LAS 500-mb height (Time T-12)	_____
(e)	LAS 500-mb height (Time T)	_____
(f)	LAS 12-hour, 500-mb height change	_____
(g)	OKC 850-mb wind direction	_____
(h)	OKC 500-mb wind direction	_____
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)	_____
(j)	OKC 700-mb height	_____
(k)	LND 700-mb height	_____
(l)	Item (j) minus Item (k)	_____
(m)	GJT 700-mb wind direction	_____
(n)	GJT 500-mb wind direction	_____
(o)	GJT directional wind shear from 850-mb to 500-mb surface (veering +, backing -)	_____
(p)	GJT 700-mb wind direction	_____
(q)	LIT 700-mb wind direction	_____
(r)	Difference in 700-mb wind direction from GJT to LIT (veering +, backing -)	_____

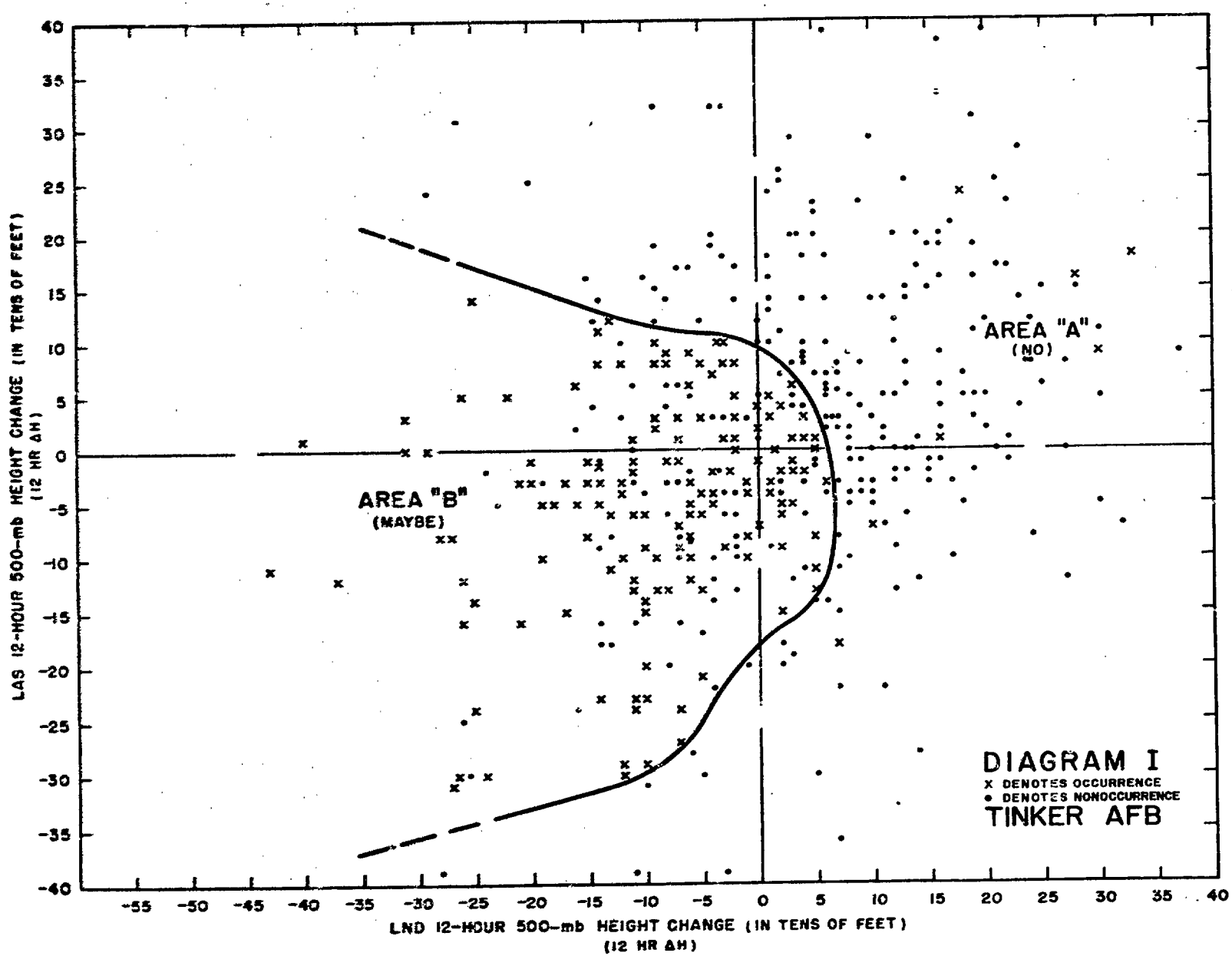
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

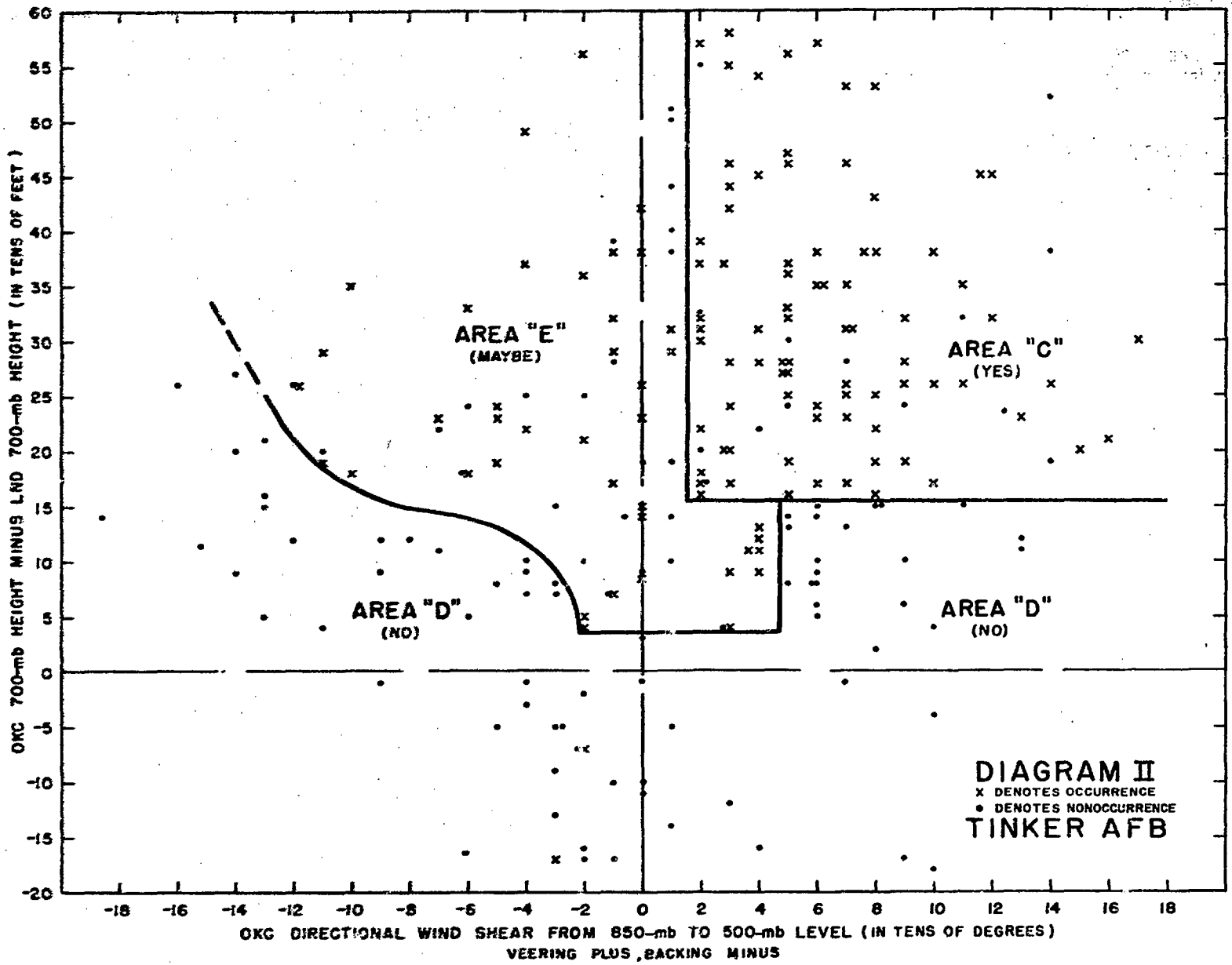
SCATTER-DIAGRAM PROCEDURE

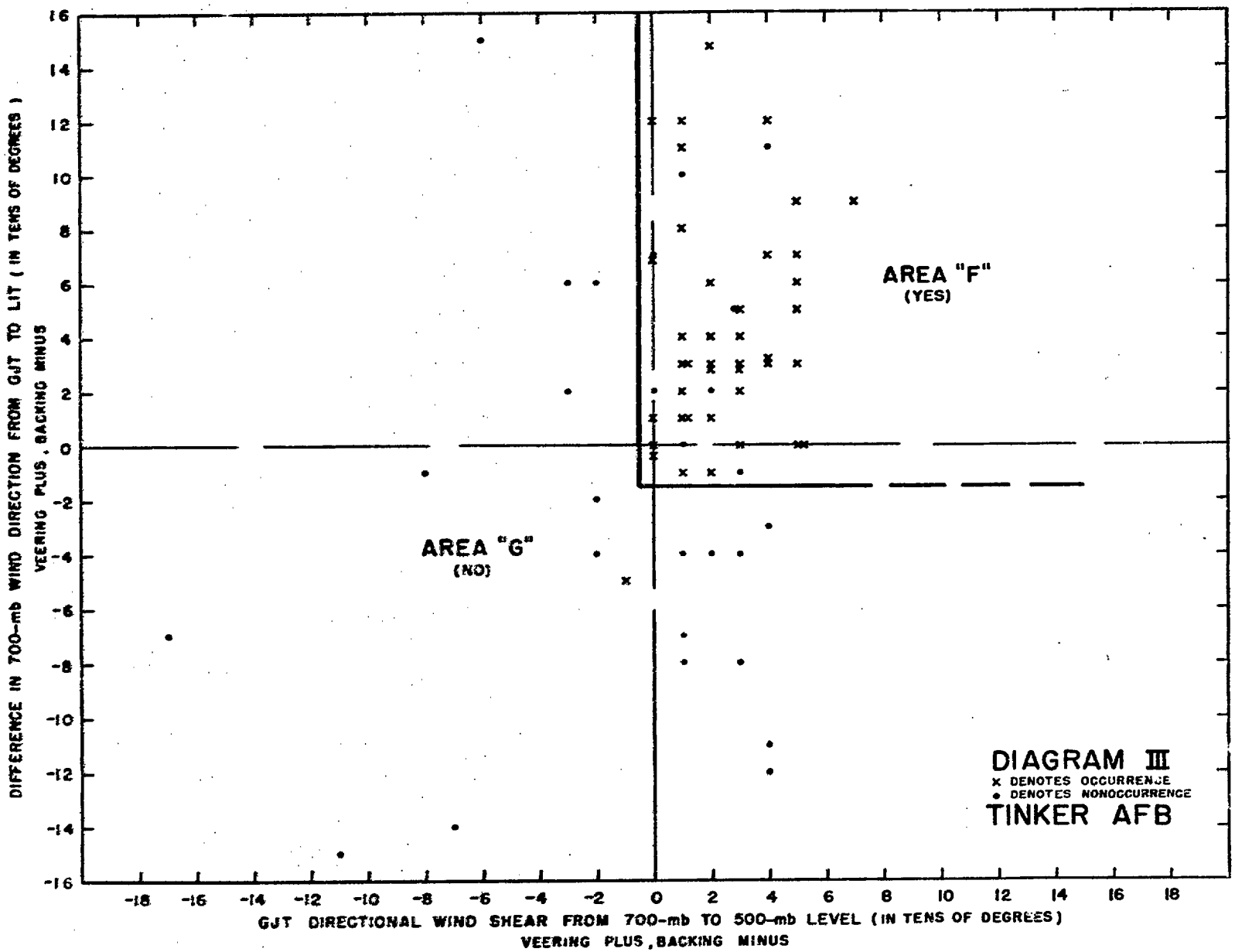
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop. _____
   If point falls in Area "B," refer to Diagram II.

2. With values from Items (i) and (l) enter Diagram II.
   If point falls in Area "C," forecast "Yes" and stop. _____
   If point falls in Area "D," forecast "No" and stop. _____
   If point falls in Area "E," refer to Diagram III.

3. With values from Items (o) and (r) enter Diagram III.
   If point falls in Area "F," forecast "Yes." _____
   If point falls in Area "G," forecast "No." _____


LAS 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
LND 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
TINKER AFB


AREA "E"
(MAYBE)
AREA "C"
(YES)
AREA "D"
(NO)
AREA "D"
(NO)
DIAGRAM II
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
TINKER AFB
OKC 700-mb HEIGHT MINUS LND 700-mb HEIGHT (IN TENS OF FEET)
OKC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-18
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
14
16
18


AREA "F"
(YES)
AREA "G"
(NO)
DIAGRAM III
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
TINKER AFB
DIFFERENCE IN 700-mb WIND DIRECTION FROM GJT TO LIT (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
GJT DIRECTIONAL WIND SHEAR FROM 700-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS

3.14. ALTUS AIR FORCE BASE, OKLAHOMA

Problem: To forecast strong, gusty surface winds of 30 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	10	2	12
Nonoccurrences	2	78	80
TOTAL	12	80	92

Skill Score = .81
Percent Correct = 96

ALTUS AIR FORCE BASE

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	LND 500-mb height (Time T-12)*		
(b)	LND 500-mb height (Time T)*		
(c)	LND 12-hour, 500-mb height change		
(d)	ELP 500-mb height (Time T-12)		
(e)	ELP 500-mb height (Time T)		
(f)	ELP 12-hour, 500-mb height change		
(g)	OKC 850-mb wind direction		
(h)	OKC 500-mb wind direction		
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		
(j)	Item (e) minus Item (b)		
(k)	GJT 500-mb height (Time T-12)		
(l)	GJT 500-mb height (Time T)		
(m)	GJT 12-hour, 500-mb height change		
(n)	SAT 500-mb height (Time T-12)		
(o)	SAT 500-mb height (Time T)		
(p)	SAT 12-hour, 500-mb height change		
(q)	CBI 500-mb height (Time T-12)		
(r)	CBI 500-mb height (Time T)		
(s)	CBI 12-hour, 500-mb height change		
(t)	SAT 700-mb height (Time T)		
(u)	OKC 700-mb height (Time T)		
(v)	Item (t) minus Item (u)		

* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

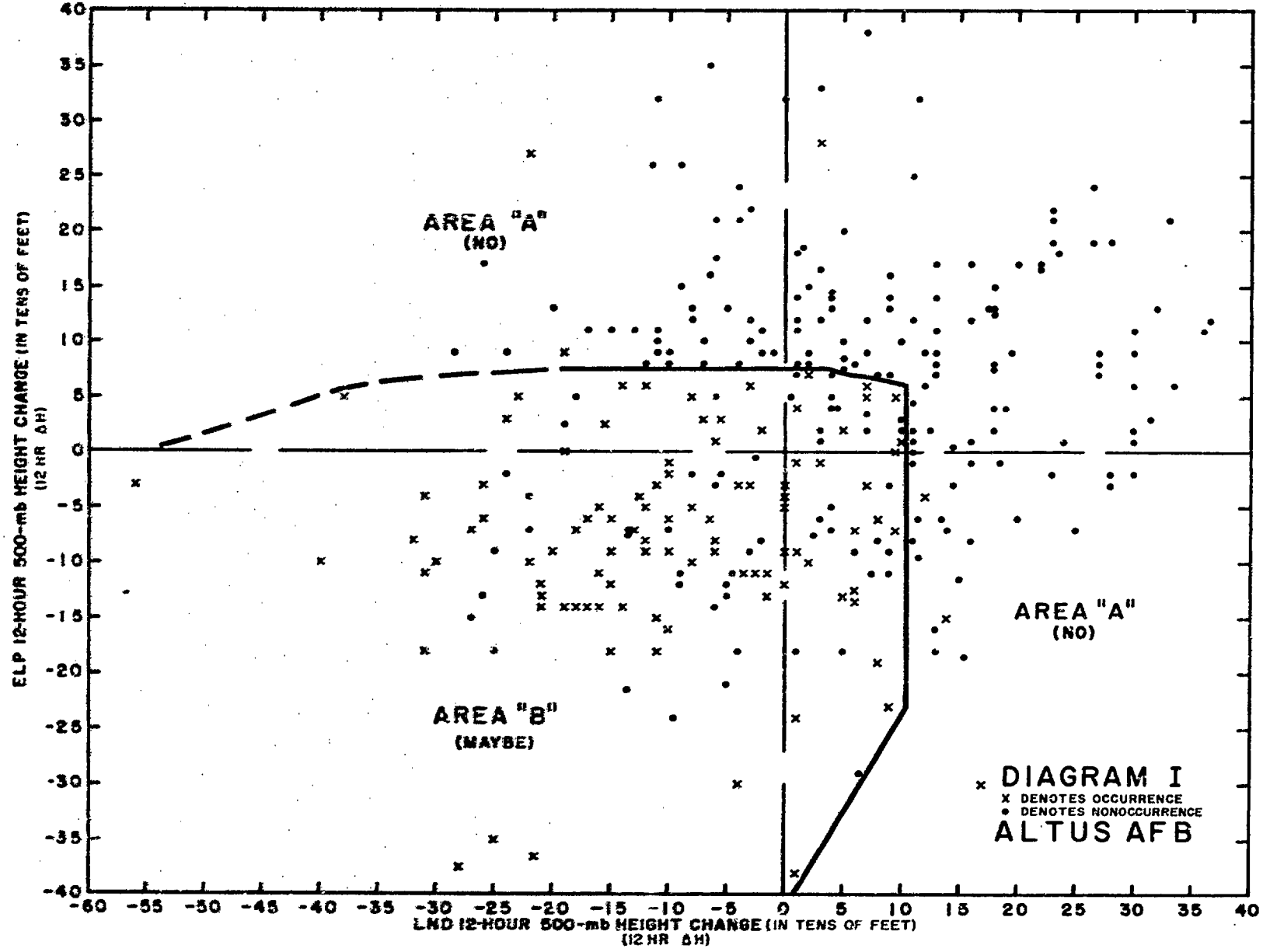
SCATTER-DIAGRAM PROCEDURE

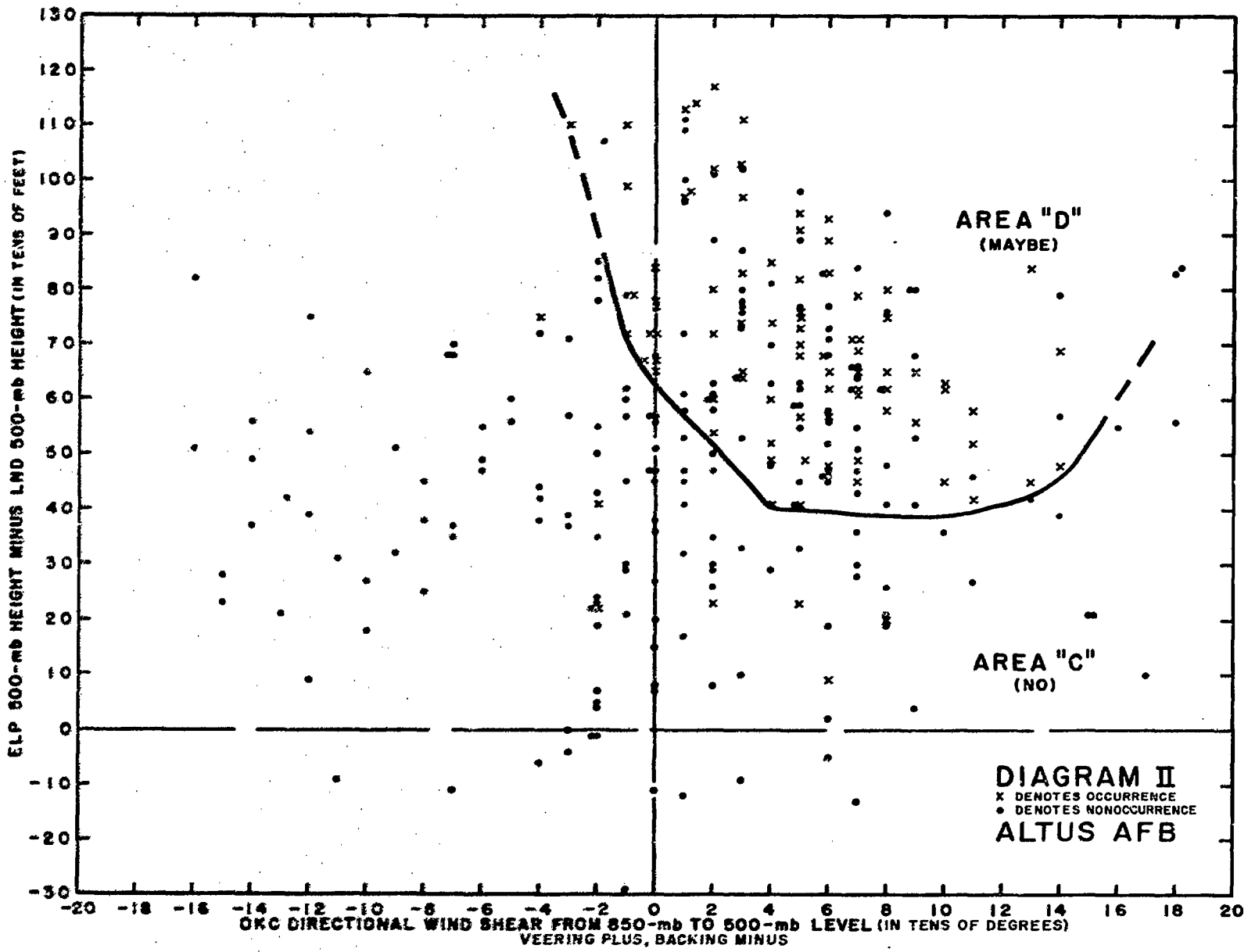
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. _____

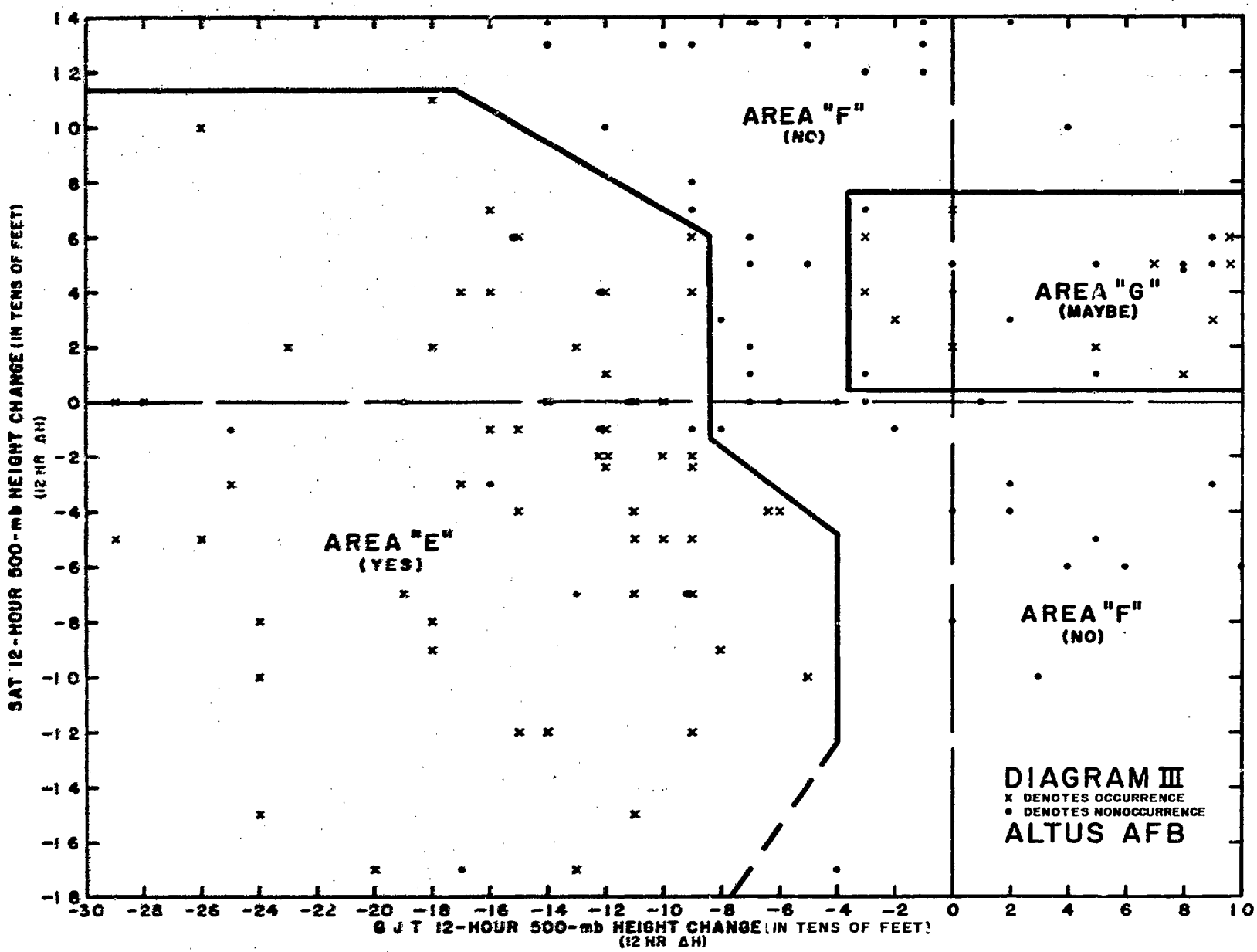
2. With values from Items (i) and (j) enter Diagram II.
   If point falls in Area "C," forecast "No" and stop.
   If point falls in Area "D," refer to Diagram III. _____

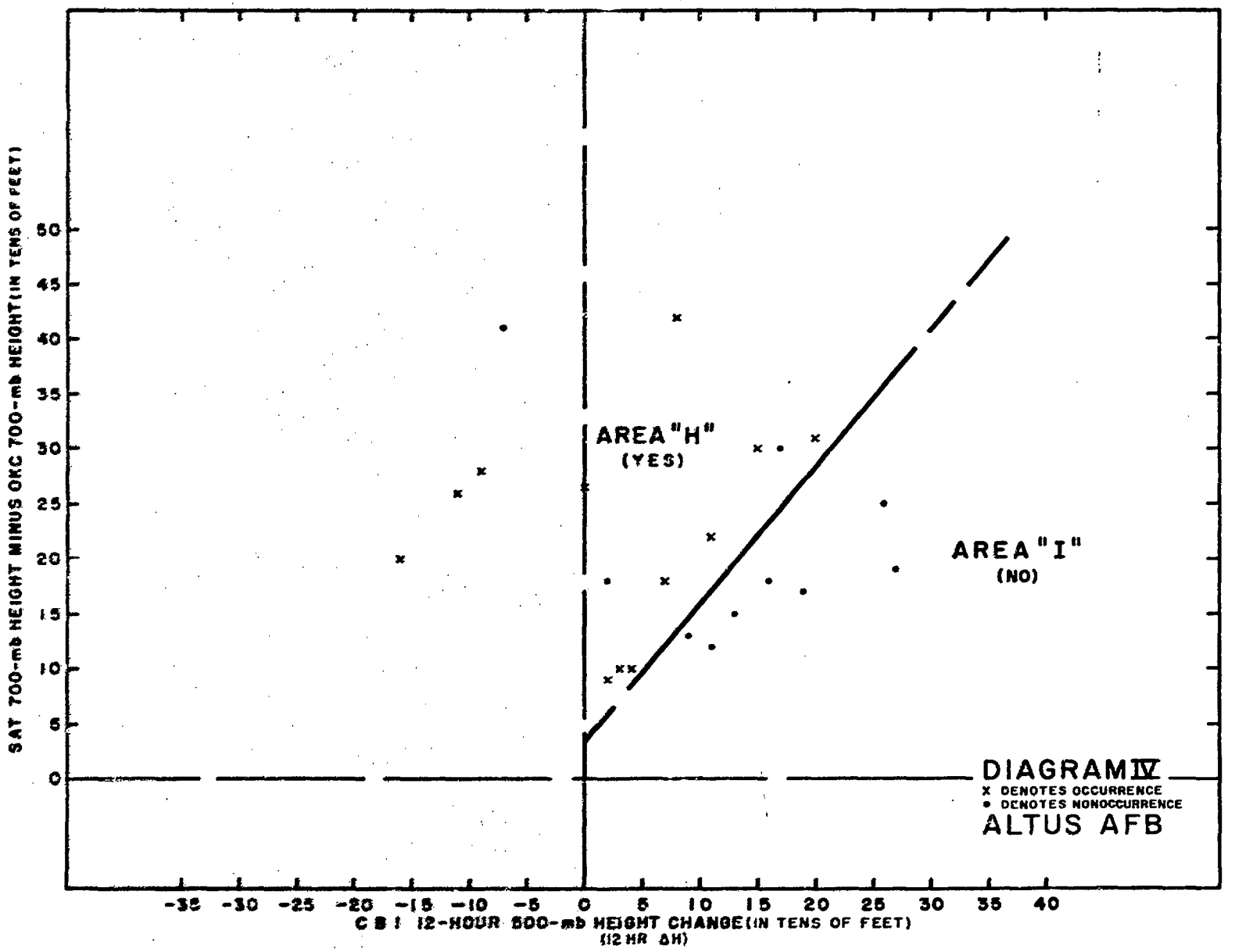
3. With values from Items (m) and (p) enter Diagram III.
   If point falls in Area "E," forecast "Yes" and stop. _____
   If point falls in Area "F," forecast "No" and stop. _____
   If point falls in Area "G," refer to Diagram IV.

4. With values from Items (s) and (v) enter Diagram IV.
   If point falls in Area "H," forecast "Yes." _____
   If point falls in Area "I," forecast "No." _____


AREA "A"
(NO)
AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
ALTUS AFB
ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
LND 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-60 -55 -50 -45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40


ELP 500-mb HEIGHT MINUS LND 500-mb HEIGHT (IN TENS OF FEET)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20
OKC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
AREA "D"
(MAYBE)
AREA "C"
(NO)
DIAGRAM II
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
ALTUS AFB


AREA "F"
(NC)
AREA "G"
(MAYBE)
AREA "E"
(YES)
AREA "F"
(NO)
DIAGRAM III
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
ALTUS AFB
SAT 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
G J T 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-30 -28 -26 -24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10


SAT 700-mb HEIGHT MINUS OKC 700-mb HEIGHT (IN TENS OF FEET)
50
45
40
35
30
25
20
15
10
5
0
AREA "H"
(YES)
AREA "I"
(NO)
DIAGRAM IV
x DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
ALTUS AFB
-35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40
C S I 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)

3.15. POST FIELD, OKLAHOMA

Problem: To forecast strong, gusty surface winds of 25 knots or more.

Evaluation: The results of the test on independent data are:

OBSERVED	FORECAST		
	Occurrences	Nonoccurrences	TOTAL
Occurrences	16	3	19
Nonoccurrences	2	94	96
TOTAL	18	97	115

Skill Score = .84
Percent Correct = 96

POST FIELD

SUGGESTED FORECASTING CHECK LIST

Date and Time _____

Items	Data Required	Values	
(a)	GJT 500-mb height (Time T-12)*		
(b)	GJT 500-mb height (Time T)*		
(c)	GJT 12-hour, 500-mb height change		____
(d)	ELP 500-mb height (Time T-12)		
(e)	ELP 500-mb height (Time T)		
(f)	ELP 12-hour, 500-mb height change		____
(g)	OKC 850-mb wind direction		
(h)	OKC 500-mb wind direction		
(i)	OKC directional wind shear from 850-mb to 500-mb surface (veering +, backing -)		____
(j)	LND 500-mb height (Time T)		
(k)	Item (e) minus Item (j)		____
(l)	LND 500-mb height (Time T-12)		
(m)	LND 500-mb height (Time T)		
(n)	LND 12-hour, 500-mb height change		____
(o)	OKC 700-mb wind direction		
(p)	CBI 700-mb wind direction		
(q)	Difference in 700-mb wind direction from OKC to CBI (veering +, backing -)		____

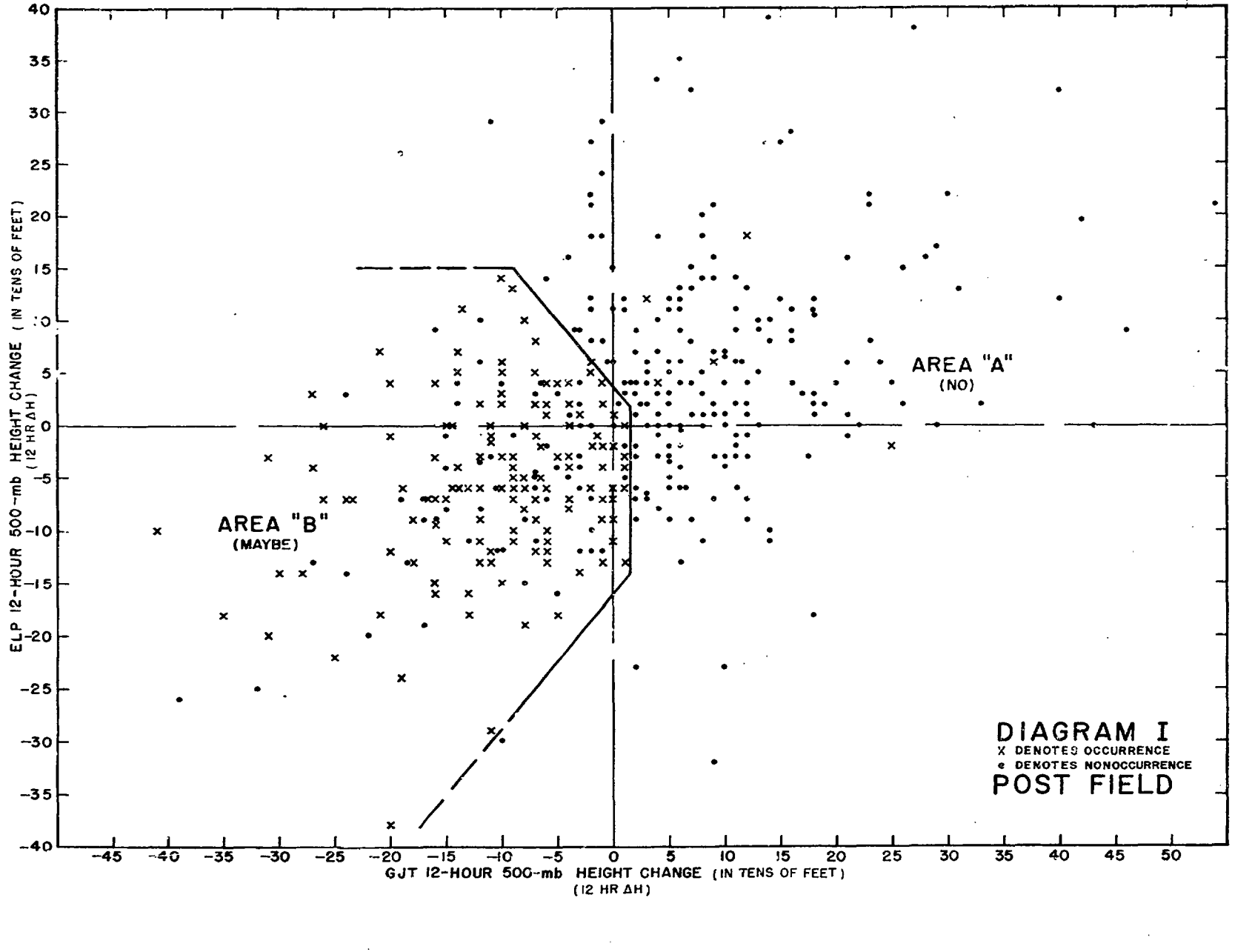
* Times are either 0000Z or 1200Z; T is current observation, T-12 is observation 12 hours previous.

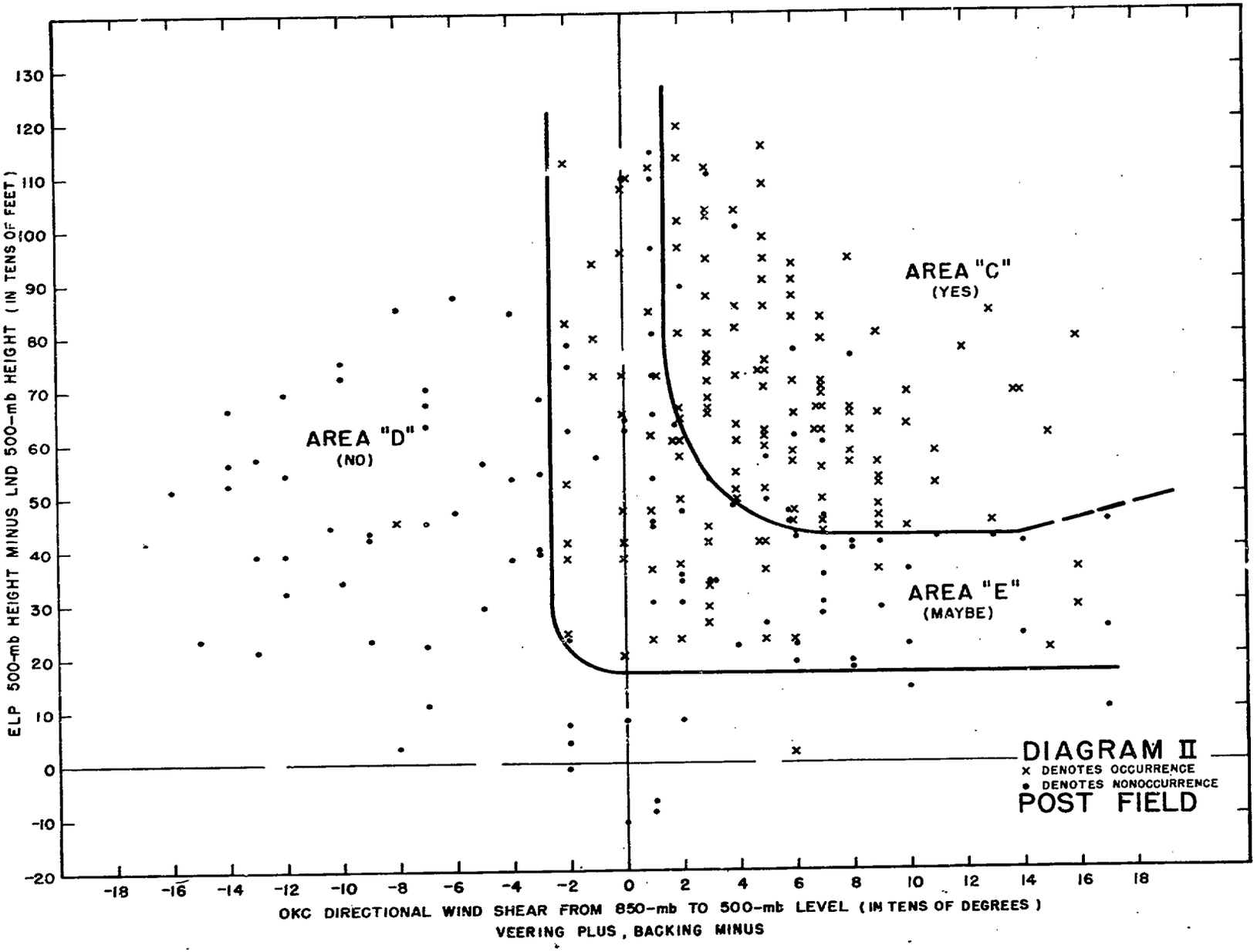
SCATTER-DIAGRAM PROCEDURE

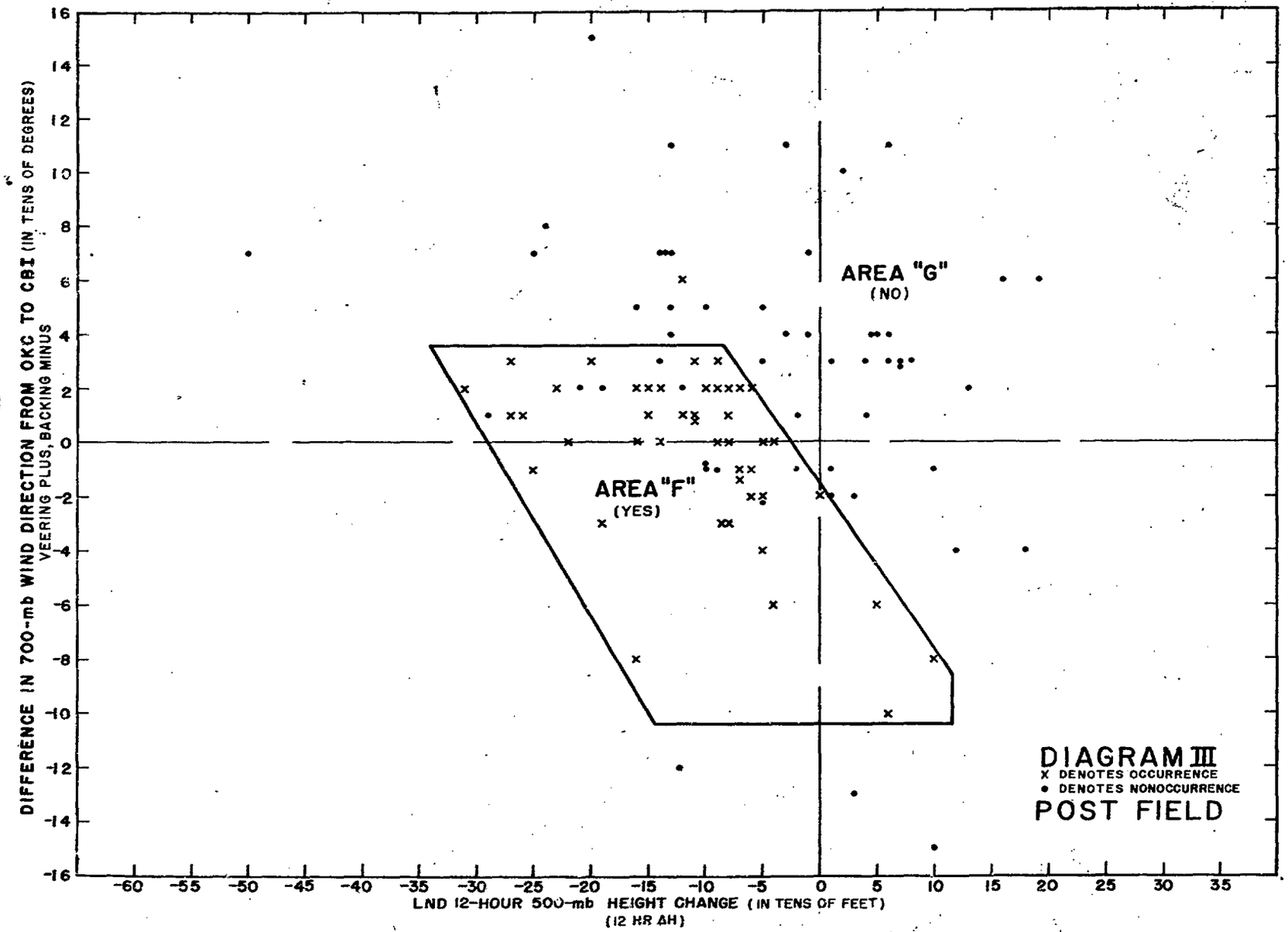
1. With values from Items (c) and (f) enter Diagram I.
   If point falls in Area "A," forecast "No" and stop.
   If point falls in Area "B," refer to Diagram II. ____

2. With values from Items (i) and (k) enter Diagram II.
   If point falls in Area "C," forecast "Yes" and stop. ____
   If point falls in Area "D," forecast "No" and stop. ____
   If point falls in Area "E," refer to Diagram III.

3. With values from Items (n) and (q) enter Diagram III.
   If point falls in Area "F," forecast "Yes."
   If point falls in Area "G," forecast "No." ____


AREA "A"
(NO)
AREA "B"
(MAYBE)
DIAGRAM I
X DENOTES OCCURRENCE
e DENOTES NONOCCURRENCE
POST FIELD
ELP 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
GJT 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-40
-35
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50


AREA "C"
(YES)
AREA "D"
(NO)
AREA "E"
(MAYBE)
DIAGRAM II
× DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
POST FIELD
ELP 500-mb HEIGHT MINUS LND 500-mb HEIGHT (IN TENS OF FEET)
OKC DIRECTIONAL WIND SHEAR FROM 850-mb TO 500-mb LEVEL (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS


DIFFERENCE IN 700-mb WIND DIRECTION FROM OKC TO CBI (IN TENS OF DEGREES)
VEERING PLUS, BACKING MINUS
LND 12-HOUR 500-mb HEIGHT CHANGE (IN TENS OF FEET)
(12 HR ΔH)
AREA "G"
(NO)
AREA "F"
(YES)
DIAGRAM III
X DENOTES OCCURRENCE
• DENOTES NONOCCURRENCE
POST FIELD

89-0873